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The Welsh Engineers' and Founders' Association
and
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A Review of the Foundry Industry of 1934

From a study of the general conditions operating within the foundry industry during 1934, we have reached the conclusion that the increased tonnage registered has been of the order of 20 per cent. An increase has been experienced by every branch, in varying magnitudes, ranging from five to as much as fifty per cent.

Light Castings Industry

No one who is familiar with the inner workings of the British Ironfounders' Association and its allied bodies could fail to be impressed with the very serious sacrifices that have been made during the year by the leading industrialists interested in this branch of ironfounding. Week after week they have had to leave their businesses to attend conferences and committee meetings in London and elsewhere. Their efforts fortunately have been extremely successful, and their organisation is now regarded as a model to be emulated amongst other employers' federations. The largest group within this section, Allied Ironfounders, Limited, has had a good trading year. Its various factories are modernising steadily, and now a number of mechanised plants are even operating successfully certain lines of goods previously thought impossible of being produced other than by hand labour. One plant, British Baths, Limited, of Greenford, now has a production bordering on 2,000 castings per week. Last September a new rainwater goods foundry opened up on the Watford Bye-pass Road, and is now employing a staff of about ninety. This establishment has shown that the existence of a strong employers' association does not stop the creation of new enterprises, but where a good case can be postulated for the creation of a new business, sympathetic support is accorded.

The second largest group entering within the sphere of light castings is Radiation, Limited. Their Luton plant—The Davis Gas Stove Company—has been working to capacity, whilst a second, John Wright & Eagle Range, has embarked on the installation of a mechanised unit for its production of castings. Electric cookers are being made in increasing quantities, but the price levels are still too low to be really remunerative. However, as most of the firms also manufacture electric fires, they manage to maintain a well balanced business.

Reference to the Board of Trade returns shows that the export market has been well maintained so far as quantity is concerned, but prices are still scarcely remunerative, and the average price for stoves, grates, etc., has receded from £49 4s. to £48 16s., whilst for cisterns the drop has been about 4s. per ton.

Heavy Iron Castings

A distinct improvement has been registered amongst foundries making really heavy castings, but a shortage of skilled men is being experienced, whilst prices could very well be augmented and still be free from the appellation of profiteering. This increased business is purely a reflection of the better condition of the various branches of engineering—shipbuilding, textile, electrical, mining, metallurgical, machine tools and civil. It has still far to go before it reaches its pre-war eminence, and with the trend of modern engineering, we think that the manufacture of heavy castings will always be on a lesser scale. It is a matter of regret that Davy Bros., of Sheffield, have had financial trouble, as few names are better known throughout the whole world as manufacturers of heavy-duty presses.

Automobile Foundries

The British automobile industry has made substantial progress during the year. The Ford foundries have settled down to steady production, through their system of carrying all stocks on the conveyor, which involves the frequent changing of the patterns on the moulding machines. Plans are now being made to cast crank shanks in an extension to the foundry. The Austin foundries have done a good deal of reorganising in their ironfoundry, and the results have been thoroughly successful. One of the pioneers of the automobile-foundry industry, Mr. Smith, of Morris, if we read his Christmas card correctly, retired at the end of last year. The unattached automobile foundries have been exceptionally busy, and in some cases, such as at Qualcast, extensions have had to be made.

The Speciality Foundries

The last few years have seen a new type of foundry come into being, comparable, in a way, with Sheffield tool-steel works in their relation to the large open-hearth plants. This new grade of foundry specialises in the production of alloyed and high-grade iron castings. Geographically, there has been no concentration, and shops are to be found in London, Stockton, Sheffield, Chesterfield, Willenhall, Leicester, Braintree, Cardiff, Kirkintilloch and elsewhere. Some of them have taken out licences for the exploitation of the Meeanhite process and are satisfied

with the prospects the system is showing. It is to these manufacturers of high-grade grey-iron castings that the industry looks for impressing upon buyers and designers a favourable impression of the true qualities of cast iron.

Pipe Castings

When the economy campaign set in, the pipe foundries felt the repercussion, but during recent months they have regained the lost ground and have consolidated their position as one of the best and most-intelligently-conducted sections of British trade. The industry will this year have exported over £1,000,000 worth of goods weighing about 100,000 tons. On the import side, over £50,000 worth has been received, almost double that of 1933. These figures require vigilance, as the advantage of sterling rates cannot be relied upon to last for ever.

Other Sections of the Grey-Iron Foundry Industry

The improvements registered amongst the mining, textile, agricultural implement, printing, and food machinery foundries have on the whole been very definite. Early this year a new mechanised foundry making castings for the cement industries will come into being at Winget's, Limited, of Rochester. The foundries making such articles as mangles, lawn mowers, hardware, small electrical parts, have been working at full pressure, and the enterprise that many of them have shown in their methods of production is indeed commendable. To mention but three, Midland Electric Manufacturing Company, Harper's, of Willenhall, and Qualcast, Limited, are firms exhibiting a maximum of intelligence in their methods of production and they are, as they deserve to be, thoroughly prosperous concerns. The roll founders have enjoyed a much better home market, but export becomes more difficult with the passage of time. Messrs. Sir W. G. Armstrong, Whitworth & Company (Ironfounders), Limited, have during last year entered this very specialised market. Research and experiment for the maintenance and improvement of quality are accelerating, but there is still need for a wider dissemination of existing knowledge.

Steel Foundry Industry

It is pleasing to note that for the first time for many years, it can be stated that the steel foundry industry as a whole is making a profit, though still incommensurate with the invested capital and accumulated experience. During the year, the Faringdon Steel Foundry has ceased production owing to technical considerations, and the space formerly occupied by the steel section is now taken over by iron castings required by the parent concern, the Leyland Motor Car Company. The well-informed article in this issue by Mr. F. J. Hemming, of F. H. Lloyd's, confirms our impression that a much better feeling is growing amongst the owners of steel foundries, and with just a little more goodwill the industry could be placed upon a proper profit-earning basis. Mr. Hemming argues that so many of the costs which make up the cost price of a steel casting are of a fixed character that there is not so very much to do after all to establish and maintain selling prices for the products of the industry.

The Malleable Foundry Industry

We have watched with a considerable amount of interest the extraordinary development of this section of the foundry industry during the last decade. The major activity has been in connection with melting apparatus, wherein pulverised fuel and oil have established themselves as capable of replacing coal and coke. Many of the installations are rotary furnaces, and the number of plants installed and working is now of a substantial character. A new installation has been made at Dagenham, which utilises coke-oven gas as a fuel for a rotary furnace, whilst a continuous furnace is engaged upon annealing. We think we might issue a warning to people studying the problem of rotary furnaces, and that is a body made for utilising one type of fuel is not suitable for operating with another sort. Each fuel demands its own particular type of furnace body. Whilst commendable enterprise has been shown in the reorganisation of the melting departments and in the better conduct of the annealing cycle, there is still much to be done in the systematic handling of the moulding, coremaking and fettling departments. Obviously, this does not apply to all shops, as these operations are very intelligently handled in such foundries as Cranes of Ipswich and Leys of Derby. This latter firm is still extending, and must now be easily the largest malleable-iron foundry in Europe. Mr. G. R. Shotton has done well to stress the necessity for more commercial co-operation amongst the malleable-iron foundry owners, as insensate price-cutting is still evident in certain sections.

Non-Ferrous Foundry Industry

Shipbuilding always appeals to us to have a profound influence on the non-ferrous foundry industry, though an examination of Dr. Donaldson's dissection does not show it to be exceptional. Yet it cannot be contradicted that the increase in business reported by the non-ferrous foundries does reveal substantial orders for ship construction and furnishing. A great achievement during 1934 was the casting of the propellers for the "Queen Mary" by two London firms, J. Stone & Company and the Manganese Bronze Company. The former concern has made considerable extensions during the year, and a magnesium foundry has been added. The recent lean years have caused much more attention to be paid to melting costs, and mechanical handling, which, with the better trading conditions now being enjoyed, is reflecting favourably on the profit and loss account. Following hard upon the heels of beryllium as a non-ferrous foundry raw material comes news of cerium, used in connection with light alloys. Indeed, the potentialities of metallurgy are unlimited. The progress made by the light-alloy manufacturers is positively astounding, and we would refer those croakers who rave about the undoubtedly marvellous work accomplished by their grandfathers, to the pictures illustrating Mr. Devereux's article on the light-castings industry. They involve a technique quite foreign to even the old masters who produced internationally-admired statuary. The prospects for the light-alloy castings industry are indeed bright, as the aircraft engineering industry is still in its infancy, whilst the craze for lighter constructions is spreading to practically every other section. In some cases it is being overdone, and it is not unknown for the owner of a modern motor-car to beg a hundredweight of scrap iron to keep his car from skidding!

Foundry Equipment

Britain is rapidly establishing itself as an important manufacturing centre for foundry equipment. One firm bearing this title is equipping a new factory for themselves at Leighton Buzzard, whilst others are gradually extending their plant and range of manufacture. Whilst, to be honest, we must credit the foreigner with the invention of many of the most popular items of foundry equipment, the experience gained through manufacturing them in this country is producing a crop of incidental improvements. Knowledge has been gradually accumulated as to the performance of various types of machines and handling equipment, which has enabled the buyer to prophesy with reasonable accuracy the savings to be expected. Britain has been somewhat slow to mechanise, but with this slowness there has been security, and relatively very few white elephants have been exhibited in the liquidators' zoo. During the year a shot-blast machine called the wheelabrator has appeared on the British market and the honour of the first installation goes to the Crane Company. The chilled shot is ejected under centrifugal force, and the great feature claimed for the machine is that it is so designed that it does not destroy itself. Its progress will be watched with a considerable amount of interest.

Vitreous Enamelling

Last year this department of the foundry and sheet-metal industries became of conscious entity in the world of technology, since it had the courage to create The Institute of Vitreous Enamellers. Coincident with this development there has been something of a boom in the trade, and on one day alone a furnace designer received orders for no less than seven stoves.

Foreign Foundries

It is perfectly evident from a perusal of our reports from overseas that most foreign foundry owners are still in the throes of depression, and our sympathies as foundrymen are with them. A certain amount of repercussion is felt in this country, because when trade is bad a firm is tempted to maintain its export business at unremunerative prices just to keep its personnel together. With the present tendency to consolidate employers' federations the time may come when international trade is carried on by quotas which leaves a margin of profit for the participants. This system is already operating for rails, tubes, tinplates and coal. It seems an artificial way of doing business, but it is the outcome of the erection of high tariff walls and intense economic nationalism.

Technical Progress

The Institute of British Foundrymen is making steady progress, both in membership and prestige on account of the extraordinarily fine work accomplished by its various technical committees. It should be borne in mind that all this work is done voluntarily, and constitutes the most difficult kind of task to maintain at concert pitch. The work thrown upon the permanent officials and the chairman and convenors is indeed onerous, and may unless very carefully handled become overwhelming. Every member of the Institute should bear this in mind when participating in the conduct of the Institute. The new costing sub-committee has done excellent work, which *inter alia* has revealed the vast amount of labour still to be expended before a complete system can be placed before the industry for approval. The employers' federations are watching this work with increasing interest, as it is likely to be of importance in their efforts to make the industry more efficient.

Conferences.

About a dozen members of the Institute participated in the Philadelphia International Congress last October, where they received an enthusiastic welcome. The Congress was an outstanding success, whilst the organisation for the visiting of the various works was brilliant. This activity was much appreciated by the visitors.

Manchester was the venue of the Annual Conference when Mr. Roy Stubbs assumed office as President, thus carrying on a well-founded, much appreciated contact between the Institute and the Stubbs' family. It was announced at the Conference that Sheffield University had decided to institute immediately a degree course in foundry practice. This action crowns the educational activities which have engaged the attention of the Institute for so many years. Mr. V. C. Faulkner, who has presided over the Institute's committee which has acted as a liaison with the University authorities, was honoured by the award of the Oliver Stubbs medal.

Research Developments

Scientific and technical developments are dealt with by the Director of the B.C.I.R.A. There is little doubt that a generation hence the in-

(*Concluded on page* 36.)

Recent Developments in Foundry Coke

By Sir JOHN FRY, Bart.

IT has been suggested that there should be imposed on industry a compulsory abstention—for five years—from the prosecution of new knowledge, in order that a thorough stock-taking could be undertaken definitely to ascertain in what directions research was most needed. If this were applied to the foundry industry, there is every reason to believe that the most urgent problem so revealed would have reference to the scientific use of coke, necessitating a fundamental knowledge of its properties.

Examination of the latest available statistics shows that whilst there has been a pronounced increase in the consumption of coke destined to be used in blast furnaces or shipped abroad, no such parallel activity is recorded in its use by the foundry industry. This may be due to the more economic utilisation of fuel, or competition from pulverised fuel as a melting medium. The former can be substantiated in some measure, as there is an increasing tendency to purchase coke on a quality basis instead of mere price consideration. It is common knowledge that more foundries are now being operated under strict scientific control, and that extensive specialisation in the manufacture of castings demands coke having rigidly-specified properties, guaranteed to remain constant over prolonged periods.

Manufacture of Foundry-Quality Coke

Many of the best types of coke continue to be manufactured in the older designs of ovens, due in part to the fact that the temperatures in such ovens are lower than in the more modern ones and in part to the location of such older ovens in areas yielding the best coking coals. The higher temperatures and larger outputs to be associated with the more modern designs of ovens, permit costs of production to be reduced. It should not be forgotten, however, that the production cost of the most-favoured brands of foundry coke must obviously be greater than that of furnace cokes made in modern ovens, because the superior physical and chemical properties of the former demand very careful blending of coal picked from various seams and involve the meticulous selection of coke batches made from lower throughputs and longer hours of burning. All of this must necessarily increase labour costs.

The displacement of the beehive by the by-product oven has rendered available to the consumer a smaller size of coke, but there is still a real demand for the larger type made in ovens 21 to 22 in. in width made under very carefully-controlled temperature conditions. By intelligently blending and carbonising coals under such conditions, coke can be produced having a regularity of chemical and physical properties at least equal, if not superior, to the beehive varieties.

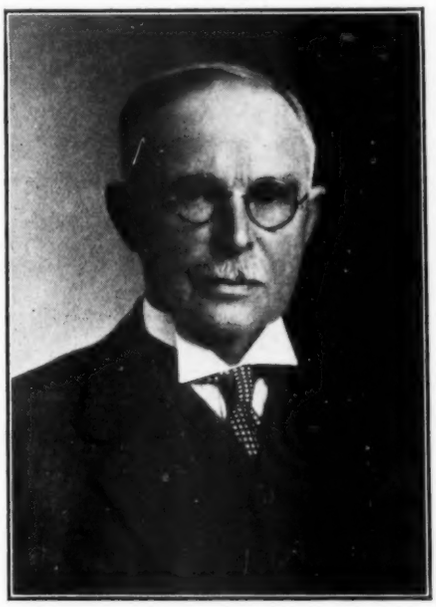
The question of uniformity is so prominently in the minds of the coke-oven managers that investigations are being carried out with a view to determining any variations in the combustible properties of the coke adjacent to and removed from the retort walls.

Fissuring

Of major importance to the foundry industry is elimination of fissuring in coke, because when initially present in a highly-developed condition, the material will suffer in transit and handling to such an extent that excessive riddling at the cupola may be involved and, moreover, there is a tendency to absorb undue quantities of moisture because of the additional area exposed to atmospheric influences. Two methods by which a complete cure has been effected are by grinding the coal to a suitable grain size and by the addition of coke dust or fusain to the coal mixture. The latter method has often yielded larger coke associated with an enhanced resistance to shattering, yet this property is not the sole criterion, unless the coke possesses a high proportion of large coke on a screening test. With this object in view, the more modern of the coke-makers have redesigned their screening and handling plants to remove "smalls" before despatch and to prevent breakage during loading.

Porosity and Melting Efficiency

Because of the poverty of fundamental knowledge, there is a sharp divergence of opinion amongst qualified technicians as to whether



SIR JOHN FRY, BART.

porosity in coke is beneficial or detrimental to the realisation of melting efficiency. Thus some enlightened users find it advantageous to employ a coke, which is dense, close-grained, and with small pores, whilst others are equally insistent upon material exhibiting a more open texture. Both schools of thought are agreed as to the essential property of uniformity and that there exists a certain amount of evidence that cokes possessing a low percentage of closed pores give the best performance. Open-textured cokes normally absorb more moisture than the denser types. The true evaluation of the inter-relationships of porosity, combustibility and calorific intensity will continue to await scientific postulation until knowledge of the structure of cell walls is more exact.

Reactivity to Carbon Dioxide

Recently more attention has been devoted to the reactivity of coke to carbon dioxide, and though this would seem to be of greater significance to the blast-furnace managers than to foundry executives, yet it is noteworthy that beehive cokes have a low reactivity and the by-product material most esteemed by the foundry industry generally has reactivity values approximating to those of beehive cokes.

Ash Content

Whilst cokemakers have met the demands of the consuming industries in the direction of lower ash, by increasing the efficiencies of their coal-cleaning apparatus, yet there are certain outlets for coke where a too severe reduction in the ash content, until it approaches that of the natural ash value of the coal, may be disadvantageous because cases exist where easy fusibility of the coke ash is essential. In such cases it may be preferable to retain a little adventitious ash, and to sacrifice ash content for ash refractoriness. Unfortunately, different observers record different fusibilities for the same ash, and, until methods of testing are more accurately standardised, users who possess no reliable facilities should accept published figures with some reserve.

Sulphur Pick-up

Though research is being undertaken by a Sub-Committee of the Institute of British Foundrymen, the Cast Iron Research Association and other bodies, into the question of sulphur pick-up by metal charges in their passage through the cupola, no final concurrence of opinion is yet available. There is evidence, however, that with a standard metal charge it is not always the *total* sulphur in the coke that determines the ultimate "pick-up," but rather the forms in which the sulphur may be present. Thus, operating with two cokes having different total-sulphur contents, the higher one may yield the lower sulphur "pick-up."

Research Activities

The Northern Coke Research Committee has described a new method of comparing the combustible properties of cokes, and by the measurement of a "critical air blast" needed to burn the coke, a means of assessing cokes has been established. It has been shown that some Durham foundry cokes of low reactivity require relatively large critical air-currents for marked combustion to occur. It has also been shown that, in general, the lowest consumptions of coke per ton of metal are to be associated with cokes having the highest shatter indices.

The Midland Cokes Research Committee has issued a scheme for the sale of furnace coke on specification, on the bases of ash, moisture, and shatter index; it appears difficult to apply this to the variety of demands emanating from the foundry industry. Performance and results are as yet the only sure criteria in foundries, and foundry cokes continue to be assessed by technicians on such bases.

The Scottish Coke Research Committee has devoted much thought and experiment to the improvement of the physical properties of coke by coal blending. There are indications that the addition to the coal of finely-ground materials of low volatile content, such as high-temperature coke and anthracite, can effect reduction in the volatile contents of the blend at the end of the plastic range. This has brought about increases in the size of the coke, and in the resistance to shattering.

The value of research is being more generally appreciated, especially in the metallurgical industries, and coke manufacturers are not only investigating problems at their own works, but are also co-operating in the general research carried out by the various committees and associations.

The Malleable Iron Foundry Industry in 1934

By G. R. SHOTTON (Works Manager, Shotton Brothers, Limited, Oldbury)

NINETEEN THIRTY-FOUR has brought with it a new spirit of optimism in the malleable industry. Following, as it did, a prolonged period of poor, intermittent trade and falling prices, the past year has attained, almost, the status of a "boom year." For the greater part of the year the majority of the malleable foundries—certainly all the more progressive, technically-controlled establishments were working to capacity.

Extensions to ensure an increased capacity, have been made, or are about to be made, to a number of plants. The increasing application of malleable cast iron in the engineering world should ensure a sufficiency of work to keep these plants fully occupied.

During quite recent years, the malleable industry has successfully passed through a transition period. A better metallurgical technique, together with strict laboratory control of raw materials and of melting and annealing processes, have inevitably led to a vast improvement in physical properties, coupled with a general improvement in finish and accuracy. The number of foundries operating on "rule-of-thumb" methods, the unreliability of whose products has, in the past, done so much to prejudice the engineer against malleable cast iron, is rapidly decreasing.

There is to-day a noticeable tendency for the bulk of business to become concentrated in a relatively small number of firms, operating on sound technical methods. Whilst the number of plants which are producing consistently first-class malleable is still comparatively small, it must be remembered that, in terms of total tonnage produced, they must be well in the majority. Though this situation has certain commercial disadvantages, it has one good feature, in that the higher standard of product turned out by these plants should lead to engineers generally becoming more appreciative of the immense possibilities of application in service of malleable cast iron.

That there is, indeed, ample scope for the expansion of the industry in this country is evident when one considers the example set by the United States, where the consumption of malleable per head of population was given, a few years ago, as being six times as great as that of this country. In this respect, the leading railway companies might well consider the example set them by their American colleagues, whose consumption of malleable is infinitely greater, both as regards bulk and variety of purpose.

Dimensional Accuracy

One indication of the increased respect exhibited by the engineers of this country for malleable cast iron (or so it might be regarded by the more optimistic of the malleable foundries) is their very noticeably increasing demands as to quality and accuracy to drawing. Many engineers are tending to demand a degree of dimensional accuracy which borders on the impossible, or rather, on the "commercially impossible." A machining operation subject to very fine tolerances is necessarily expensive, and it should be borne in mind that the same conditions, to a greater or less degree, are applicable to the production of castings.

Whilst all progressive foundrymen welcome some tightening-up of engineers' requirements, as being an excellent incentive to further progress in foundry technique, a better appreciation by the engineer of the many factors which influence accuracy in castings is necessary to establish a standard which is mutually acceptable to engineer and foundryman alike. It is quite understandable that engineers should be perplexed by the readiness with which a foundry will accept a tolerance of perhaps 0.01 in. on a 6-in. dimension in what appears to be quite an intricate casting, and yet will express its inability to work to a tolerance of $\frac{1}{32}$ in. in another design.

Certainly the onus of explaining such apparent inconsistencies lies with the foundry industry itself, and in this respect the Technical Committee of the Institute of British Foundrymen is doing excellent work. The possibility of evolving some form of specification covering tolerances on casting dimensions is at present being investigated by them. Whatever the outcome of this investigation may be, it is certain that the thorough ventilation of the subject will be of considerable benefit to the engineer as well as to the foundryman.

MR. G. R. SHOTTON.

Technical Development

The technical progress of the industry in 1934 has been considerable, though comparatively little new ground has been broken. A steady advance in melting practice and the technique of annealing has been evident, a considerable improvement in physical properties being recorded by several plants.

The rotary furnace continues to gain in popularity as a melting medium, though almost entirely at the expense of the cupola. Where large tonnages are being handled, it is very questionable if any advantage in running costs can be shown over the air furnace or open-hearth furnace. The lining trouble in the rotary furnace has still not been entirely overcome, so that in respect of long-service life and also flexibility of control, the two latter-named furnaces can still claim an advantage.

Pulverised coal and oil are strongly competing as a firing medium for rotary furnaces, while one plant has recently put into operation a rotary furnace which is fired with coke-oven gas. Though an interesting innovation, this latter method is obviously not capable of general application. The use of pulverised coal for the firing of annealing furnaces is now becoming an established practice, and during 1934 several new installations have been made.

Annealing Cycles

Short-anneal malleable has not been further developed to any marked extent. Generally speaking, the physical properties of such material falls well short of those obtained on malleable produced by the standard annealing cycle. That a large potential market exists for such material cannot be doubted, but the difficulty of producing a uniform product has so far prevented its more extended application.

The United States has made more progress in this respect, and can now claim several plants working to annealing cycles of from 30 hrs. to 100 hrs. The very short cycles have only been achieved by the use of the electric furnace, and, even so, it has been usual to utilise two or more furnaces maintained at varying temperatures, the annealing charge being transferred from one furnace to the other at the end of each successive stage in the annealing process.

An annealing cycle of 80 to 100 hrs. has, however, been operated in a single-batch type annealing furnace. Very careful control of temperature is the essential factor, and the adoption of a high temperature during the first soaking period in which equilibrium is attained becomes necessary if an appreciable saving in time is to be effected.

The highly critical nature of such an annealing cycle inevitably leads to a lowering in the standard of the final product, and to some measure of inconsistency in quality unless a most rigid temperature control is effected. It is a noticeable fact that the bulk of the short-anneal malleable made in the United States is produced in those plants making castings for their own consumption.

The after-heat-treatment of malleable cast iron has been the subject of investigation by a number of plants. It would certainly appear to present a fruitful field of development for special-purpose applications. A suitable heat-treatment after annealing can produce a material of high tensile strength, moderate ductility, and some resistance to wear. The main factor at present retarding its commercial development is the extra cost involved by the after-treatment, but this may be offset in the future when potential consumers become more conversant with its attributes.

The addition of alloying elements, such as nickel, chromium, etc., has not met with any commercial success. The balance between total carbon, silicon, sulphur and manganese is already of such a critical nature that the further addition of an element radically affecting the graphitising propensities of the metal becomes fraught with great danger. Some considerable amount of investigation has been carried out on the subject, but no results of any practical value have emerged.

In this country, technical progress during 1934 has been mainly concerned with improvements in physical properties rather than in seeking new and startling manufacturing methods. That some success has attended these efforts is instanced by the fact that several producers of black-heart-type malleable are now regularly producing material yielding elongation figures exceeding by more than 100 per cent. the requirements of the B.S.I. and Admiralty specifications.

Trading Activity

A considerable improvement in business has been apparent during 1934. Once, again, the

(*Concluded on page 6.*)

Developments in Shipbuilding, Marine Engineering and the Foundry Industry

By J. W. DONALDSON, D.Sc. (Metallurgist, Scott's Shipbuilding & Engineering Company, Limited, Greenock)

THE year which has just gone has been an epoch-making one in the annals of shipbuilding, in that it has witnessed the launch of the largest ship built so far, the "Queen Mary." After such an event, it is a fitting time to review the developments which have taken place during recent years in shipbuilding and marine engineering in so far as they affect the foundry industry.

During the last two years there has been a gradual improvement in the shipbuilding and marine engineering industries from the slump which took place in 1931. This improvement has resulted, not so much from the building of merchant ships, as from the placing by the Admiralty of larger naval programmes during those years, than have been placed during any other years of the post-war period. The construction of such ships, both naval and merchant, has meant more work, not only to those engaged in the actual building of the hulls and engines, but also to many in other industries, and particularly to the iron and steel, non-ferrous, engineering and electrical industries. In this respect the foundry industry, both in its ferrous and non-ferrous branches, has benefited to a considerable extent.

Reaction on the Foundry

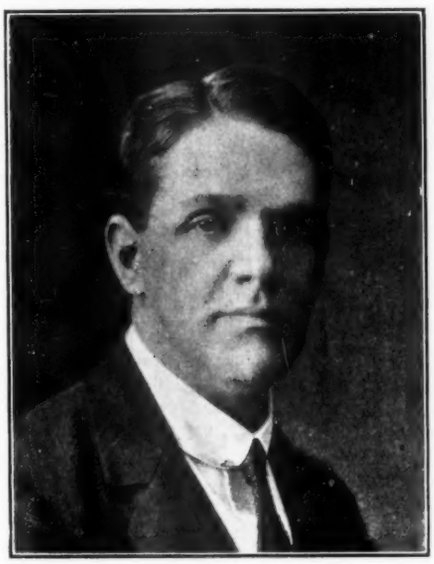
The extent to which the foundry industry participates in the construction of a ship and its engines can be judged by considering the castings necessary in the building of a ship of, say, 10,000 tons deadweight, propelled by engines of approximately 6,000 h.p. If the power was developed by reciprocating machinery, such machinery would weigh approximately 600 tons, excluding boilers and auxiliaries, and of that weight 279 tons would represent cast iron, 33 tons non-ferrous metals, and about 8 tons cast steel. Turbines to develop the same horsepower would have a total weight, excluding boilers and auxiliaries, of 390 tons, which would include 145 tons of cast iron, 4.75 tons of cast steel and 16.75 tons of non-ferrous castings. In a Diesel engine of similar horse-power, the total weight would approximate to 760 tons, excluding auxiliaries, and include 392 tons of cast iron, 21 tons of cast steel and 20 tons of non-ferrous metals.

TABLE I.—*Weights of Castings.*

Material.	Steam reciprocating.	Turbine.	Oil engine.
	Tons.	Tons.	Tons.
Cast iron	279	145.0	392
Cast steel	8	4.75	21
Brass, gunmetal, etc. ..	13	2.75	7.5
White metal	6	2	3.5
Propellers	14	12	9
Total	320	166.5	433

The detailed weights for the various castings are given in Table I, and are subject to variation for ships of different classes and speeds. The material for the hull would include at least 50 tons of steel castings and 20 to 30 tons of cast iron.

In Table II are given the gross-tonnage figures for shipbuilding and the horse-power figures for marine engineering for the United Kingdom for the year 1929, 1932, 1933 and 1934. Those figures show how the trade depression has affected the shipbuilding industry. The year 1932 was an extremely bad year and also the earlier part of 1933, but with the placing of orders already referred to there was a distinct improvement during the latter part of 1933, and this continued during 1934. The recently-placed Admiralty work and orders for new merchant tonnage, together with the work in hand, indicate that this improvement will continue slowly during the present year, although world trade will have to improve and many more orders will have to be placed before the output of 1929 is attained. Every 10,000 h.p. of engines, however, and to a lesser extent every 100,000 tons of shipping ordered means work for the foundry



DR. J. W. DONALDSON, D.Sc.

industry and is to be welcomed by those engaged in its various branches, whether cast iron, cast steel or non-ferrous.

Shipbuilding

The bulk of the castings which are used in the construction, of the hull of a ship are of cast iron and cast steel, with a smaller proportion of non-ferrous castings, principally gunmetal in the case of naval work and brass in the case of merchant work. The proportion of such castings in relation to the steel used is small and varies according to the class of ship built. In a similar manner the proportion of non-ferrous castings used varies, being increased in high-class passenger ships and in naval vessels, and there is a tendency during recent years for this increase to be more pronounced, due to the replacing of iron castings by non-ferrous castings, having increased corrosion-resisting properties.

The main hull castings, the stem, stern post, rudder frame, and propeller brackets are usually cast in steel. Recently, however, there has been a tendency to replace parts such as shaft brackets by forgings, and to fabricate such parts as stems. The fabrication of stems either in whole or in part from rolled steel by means of welding is a distinct innovation, and is one which the steel-founder has got to face in the future. Welding in ship construction is comparatively new, but the success which has been obtained from it and its more extended use shows that it has come to stay, and wherever it is shown that it is more economical to fabricate a part instead of casting it, and at the same time to obtain an equally strong, if not a stronger, member, then the tendency will be for the adoption of such technique.

Steel Castings for the "Queen Mary"

The weight of steel castings in the hull of a ship varies with the size of the ship. In this respect it is of interest to note the weight of some of the castings for the "Queen Mary." The cast-steel rudder frame which was made in parts had a finished weight of 110 tons, the stern frame, the largest of its kind ever made, weighed 190 tons, and the cast-steel inner-shaft brackets weighed 120 tons. In all, the steel hull castings weighed over 600 tons, the largest weight of steel castings so far used in the construction of a ship, and their manufacture, treatment and testing has involved the application of all the latest developments in steelfoundry practice.

Steel castings for shipbuilding purposes are usually of plain carbon steel of 28 to 34 tons per sq. in. tensile, when annealed. It is interesting to note, therefore, that an alloy steel was used recently for castings for marine purposes. This was in the Norfolk Navy Yard, U.S.A., where anchor chains were manufactured from nickel-chromium steel castings containing C 0.35, Ni 1.5, and Cr 0.6 per cent. The use of alloy-steel castings for such a purpose is new, as anchor chains are generally made of drop-forged plain carbon steel, although nickel steels have also been used recently for such forgings.

Light Alloy Castings

Non-ferrous castings in hull construction are used for such parts as valve seats, side lights, deck fittings, etc., and are usually cast in brass or gunmetal. In naval construction, however, in order to save weight, many such parts have for some time been cast in aluminium alloys, and the uses of such alloys continue to increase, and have recently been extended to merchant work for the manufacture of sidelights and fittings in high-class passenger ships, also with the object of saving weight. The use of light alloys for such purposes has been facilitated by the production of the modified alloys of aluminium containing 10 to 14 per cent. silicon, which are more resistant to corrosion by sea water or sea air than any other aluminium casting alloys. In the last two or three years there has also been an increasing number of small copper-nickel and Monel metal castings used principally for the cabin, galley and pantry fittings of passenger ships.

TABLE II.—*Shipbuilding and Marine Engine Outputs.*

Year.	Tons.	h.p.
1929	1,623,430	1,872,667
1932	238,008	672,756
1933	161,269	328,513
1934	579,676	1,487,682

Propeller and Steering Gear

The development of greater speeds and of larger ships has of recent years produced a number of problems with which the foundryman has had to deal. One of these is the manufacture of suitable propellers to withstand the erosion set up by fast-running engines. In deal-

ing with propeller problems the design, the composition of the material, and the technique of manufacture have all had to be considered and have all helped toward the production of more reliable and satisfactory propellers. In Table III are given the weights and sizes of propellers fitted in some of the large passenger liners, indicating the developments which have taken place, particularly within the last three years.

TABLE III.—*Propellers—Weights and Sizes.*

Ship.	Casting weight.	Finished weight.	Size Ft. in.
"Mauretania"	29	18.25	16 9
"Europa"	27	14	15 0
"Bremen"	35	18.75	16 5
"Empress of Japan" ..	32	20	20 0
"Empress of Britain"	33	24.5	20 0
"Queen Mary" ..	53	35	20 0 (approx.)

Propellers for high-speed vessels are usually manufactured of special high-tensile brass, made by carefully controlling the various alloying elements and by additions of nickel, and the development of such high-duty alloys has given material which is very resistant to erosive conditions. Cast-iron propellers are still used to a fair extent for cargo ships and smaller craft, and recently attempts have been made to improve their resistance to corrosion and erosion by protecting the iron with a nickel deposit. Propellers so treated, fitted to trawlers, have been found to be in good condition after many months' service.

Cast 3½ per cent. nickel-steel propellers have also been fitted to a number of ships for service in the icefields. It is claimed that the adoption of such steel, which combines toughness with resistance to shock at low temperatures, has helped to solve the problem of preventing breakages, when steaming through icefields.

In the manufacture of steering gears, castings of cast iron, gunmetal, and phosphor-bronze still continue to be used in fair quantities, but there have been no marked developments in the use of such castings, except with regard to size for the steering gears of some of the larger ships.

Marine Engineering

During the last few years there have been no marked developments in marine-engine design, either in steam or internal-combustion engines. Naval vessels continue to be propelled by turbines except in the case of submarines and very small craft. In merchant ships at present building in this country, internal-combustion engines predominate over steam engines, either reciprocating or turbine, in vessels of over 6,000 tons; but under this tonnage steam-driven vessels exceed motor driven.

Ordinary cast iron still continues to be used for such parts as bedplates, gear-case covers, columns, gear-wheel centres, etc., although there has been a tendency to replace such iron with high-duty iron in order to reduce weight. Some fairly large castings have also had to be made during the last year or two for ships, such as the "Empress of Britain," "Normandie" and "Queen Mary." For the new Cunarder, each of the four turbine gear-case bottoms weighed 54½ tons as finished castings, and the gear-wheel centres 51½ tons. The manufacture of such castings requires the most up-to-date foundry practice and strict metallurgical control.

Recently the uses of fabricated steel parts have been introduced into marine engineering, similar to their introduction into other branches of engineering. Bedplates, gear-case bottoms, and gear-case covers have been manufactured by the welding of mild-steel plates, and there is a decided tendency to a more general application of such fabricated parts. This is a trend in modern marine engineering to which the foundryman will require to give serious consideration in the near future.

High-Duty Cast Iron

The use of high-duty cast irons for the important parts of internal-combustion engines, such as cylinder liners, cylinder heads, pistons, piston rings, and valves, and for turbine and oil-engine parts, which have to meet the new Admiralty specification, continues to increase. The service obtained from such high-duty irons, by whatever process they are prepared, under the action of super-heated steam and in their resistance to wear, shock, and growth, has been satisfactory, and their use has enabled the marine-engine designer to reduce weights in various types of marine engines. The satisfactory service conditions obtained from these high-duty castings has resulted from much research work, from scientific control, new methods of melting, and improvements in methods of moulding and casting.

That high-duty irons of the type referred to have given satisfactory service is perhaps one of the reasons why alloy cast irons have not been more generally used in marine engineering. Another reason is the cost of alloy cast-iron castings for most marine-engine parts. Where those irons have been used for such parts as cylinder liners, pistons, piston rings, piston skirts, etc., in internal-combustion engines, satisfaction has been obtained from them particularly with regard to wear, and their use has more than justified their extra cost. That their application will be extended in the future, there is not the slightest doubt, particularly dense, close-grained nickel cast irons for such parts as pump bodies; nickel-chromium cast irons for cylinder liners and pistons on account of greater strength, hardness, heat resistance, and non-growing properties, and in their hardened condition for cams; Nitri-cast iron for cams and hard-wearing parts; and alloy corrosion-resisting irons for pump parts.

Developments in marine engineering in relation to the non-ferrous foundry industry have been in a more extended application of non-ferrous alloys and in the use of certain special non-ferrous alloys. These special alloys include special brass and bonzes, copper-nickel alloy, and light alloys.

Nickeliferous High-Tensile Brass

The high-duty copper alloys used for castings are special high-tensile brass and silicon-bronze. The addition of 2 to 3 per cent. of nickel to high-tensile brass has been found to be beneficial in increasing the ductility of the alloy and its resistance to corrosion. Its use for propeller blades has already been referred to, and it has also been used for certain other castings. Silicon-bronze or copper containing 3 to 4 per cent. silicon with or without the addition of iron has been used to a limited extent in marine work, as a substitute for Admiralty gunmetal, due to its superior mechanical properties, which allows of a distinct saving in weight. Bronzes containing up to 10 per cent. nickel have also given satisfaction for such parts as pump liners and slide valves.

The increasing demand for strength, lightness, and immunity from corrosion in marine work has increased the demand for castings in Monel metal and alloys of copper and nickel, and such alloys find a constantly-increasing application in the manufacture of valves, and valve seats in high-pressure boilers and other parts of the steam line where superheated steam is used, and for impellers, etc., in the manufacture of pumps. The development of high pressures and temperatures has also necessitated the use of castings of special nickel-chromium-iron alloys of very high resistance to oxidation and scaling.

"Y" and "R.R." Alloys

The necessity of reducing weight and the discovery of new light alloys more resistant to sea water, and of methods of protecting light alloys against corrosion by sea water have led to more extended use of such alloys in marine engineering and shipbuilding. In naval work many tons of aluminium alloys are used, of which a large proportion is in the form of castings for sidelights, frames, stanchions, hand wheels, pedestals, and brackets in hull construction, and in the form of doors, gear-case covers, wheels, pump bodies, and parts of electric motors in engine work, and the use of light alloys for similar parts in merchant work is increasing. In the manufacture of pistons for submarine Diesel engines and for auxiliary marine oil engines the heat-treated "Y" alloy and casting alloys of the "R.R." group are being increasingly employed and better castings are being obtained from such alloys by the new methods of degasification. The fact that satisfactory pistons of 20 in. dia. and weighing over 3 cwts. have been cast with tensile strengths of over 20 tons per sq. in. are an indication of the advance which has taken place in the manufacture and use of such alloys.

The Malleable Iron Foundry Industry in 1934

(*Concluded from page 4.*)

automobile industry has absorbed a very considerable proportion of the total output, and this would appear to be one market in which the use of malleable cast iron is definitely extending. Its ease of machinability and the intricate forms in which it can be cast, affecting substantial saving in weight while yet retaining ample margin of strength, render it invaluable to the automobile engineer.

The shipbuilding and agricultural machinery industries have been a little brighter, but cannot as yet show any lasting improvement. A good demand for malleable castings has again been evident in the electrical industry, while business in castings for general engineering purposes has been very active, particularly in the first half-year.

The improvement in trading conditions has also been reflected in the light-castings industry. The brisk demand for cycle fittings, etc., which was so noticeable in 1933, has in no way diminished, and continues to absorb a very large proportion of the output of white-heart malleable.

Economic Considerations

Despite the very considerable increase in business, selling prices in 1934 showed little improvement. The serious depression in trade which has existed in recent years has resulted in a considerable excess of supply over demand, favouring a "buyers' market." The development of the modern buying system, particularly in the case of the large consumers, and the consequent "playing off" of one foundry against another led to a very serious fall in prices. Having once become established by buyers, there is little hope of appreciably raising these low, and often quite uneconomic, selling prices. Consequently, manufacturers must look to improvements in production methods as a means to better remuneration for their labour. Considering that foreign competition is almost non-existent, there is surely no need for such severe internal competition, and it is to be sincerely hoped that a lasting improvement in business will lead to less of that futile price-cutting that has been so evident in the past. With the ever-widening field of applications for malleable cast iron, attendant on its continual improvement in quality, it will surely rest with the malleable industry itself to see that the commercial possibilities are fully exploited. A better spirit of co-operation and mutual understanding should ultimately result in a big expansion of production with a correspondingly higher scale of remuneration for all concerned.

The Work of the Institute of British Foundrymen

By ROY STUBBS, President

THE work of a technical society usually progresses steadily from year to year, and it is only occasionally that one is able to report new developments of a spectacular character. This remark applies to the activities of the Institute of British Foundrymen, whose progress during the past year has been steady; the services which it gives to its members have continued with unabated vigour and, wherever possible, improvements have been introduced.

Organisations such as the Institute are not conducted with the primary object of making a profit; the income is expended on the services which they provide, but fortunately the Institute usually is able to show at the end of the year that its income is somewhat in excess of its expenditure, and these happy results have enabled it to build up a small balance for unforeseen contingencies. At the time of writing, the financial year ending December 31, 1934, is not completed, but as far as can be seen the results will be satisfactory.

It is common experience that membership of technical institutes fluctuates to some extent with the state of trade, and there is usually a time lag between changes in the trade barometer and changes in the membership of the society. During the early part of the year the Institute's membership reflected the severe depression from which the trade of the country was just emerging. There was a slight reduction in membership, which, however, was very small when one considers the difficult times through which many of the members were passing. We believe that this reduction in membership will be more than neutralised by the large number of new candidates for membership who are presenting themselves. At the next meeting of the General Council the number of candidates whose applications will be considered will be the largest at any one meeting for some years.

Papers and Meetings

The principal media by which technical societies operate are the presentation of Papers and visits to works. Numerous works visits have been arranged during the past year, not only by Branches, but also in connection with the Annual Conference, which was held in June. In recent years several of the Branches have combined a visit to an important works with a Paper or lecture, usually dealing either with the activities of the works which has been visited or with some allied subject. This arrangement has proved very successful, and it appears that it will become a permanent feature of the activities of many Branches. Furthermore, the organisation of joint meetings between Branches, and also between one Branch and the local section of another technical society, has proved popular, and has enabled members to broaden their technical interests.

One of the most notable of the Branch functions organised during the year was the joint conference between the East Midlands and the London Branches, which took place during the month of November. This conference extended over two days, and included a visit to the Ford Motor Works at Dagenham, a session for the discussion of Papers, and a dinner. The technical value of a gathering of this kind is considerable, and, furthermore, it enables those who are fortunate enough to attend, to extend their acquaintanceships and undoubtedly helps to promote a feeling of unity between the Branches concerned.

During the last few years, Sub-Committees of the Technical Committee have presented several reports or Papers to the Annual Conferences. These reports, embodying as they do the considered views of committees of experts, are authoritative, and review the present position of the respective subjects. The latest report to be so presented was that of the Sub-Committee on Cast Iron, which was included in the programme of the Manchester Conference. During the present session this report is being presented and discussed at several of the Branches.

Additionally, the Costing Sub-Committee has prepared an interim report dealing with the first section of its work, namely, melting costs. This report has not yet been presented to an annual conference, but during the winter session it is being discussed by a number of Branches, who

MR. ROY STUBBS.

are invited to submit their criticisms to the committee and also their suggestions for future work.

The policy of discussing such reports before various provincial Branches is encouraged strongly by the General Council. The work in preparing the reports is of considerable magnitude, they are of the utmost value, and it is felt that a larger body of members should have opportunities of discussing them than is possible at an annual conference.

Technical Committee

During recent years our activities have been broadened through the work of the Technical Committee and its various Sub-Committees, each of which covers some branch of foundry technique and is engaged in exploring present-day knowledge with regard to its own particular department. From time to time the Sub-Committees issue reports giving up-to-date information of a character which can be applied readily. Several of these reports have been published, the latest being those of the Sub-Committee on Cast Iron and the Costing Sub-Committee, to both of which reference has been made.

The Sub-Committee on Malleable Cast Iron, which prepared a report some two and a-half years ago, has since continued its work and has conducted an exhaustive inquiry into the question of permissible tolerances on malleable-iron castings. Investigations into the possibility of correlating physical properties of malleable cast iron with microstructures, and the possibility of utilising standard-sized test-bars, are also in hand.

The Steel Castings Sub-Committee is conducting a practical investigation into various moulding troubles and causes of defects, and is also reviewing the physical properties of steels made under different processes.

A considerable amount of data has been accumulated by the Sub-Committee on Non-Ferrous Castings, some of which will probably be submitted to the appropriate authorities with recommendations that it be embodied in standard specifications. This committee has also undertaken joint work on the review of melting furnaces for various non-ferrous metals with the Melting Furnaces Sub-Committee. This latter committee is engaged additionally on an extensive review of the applications of furnaces to all branches of foundry practice. The committee has recently circulated to a number of foundries a questionnaire asking for information on the subject of cupola linings and patching materials. An exceptionally large number of replies were received; these replies are now being tabulated, and after further checking with the firms who have supplied the information, a report will be put at the disposal of the members of the Institute.

The Sands and Refractories Sub-Committee has continued practical investigations on the various methods of sand testing which it recommended in its report given to the 1933 Conference, and is now endeavouring to co-operate with a number of firms and individuals throughout the country with a view to observing the practical value of the tests which it recommended.

Additionally, the Technical Committee and its Sub-Committees deal with technical inquiries from members of the Institute, and the Committee has continued to be the medium through which the Institute is represented on other technical bodies, such as the British Standards Institution. The committee forms a useful medium for the practical observation of the results of modern research, and for putting those results before the Institute in a manner in which they can easily be applied. The members carry out a considerable amount of work and attend meetings in their own time and at their own expense, and the Institute is indebted to them for the valuable services which they render to the industry as a whole.

Educational Work

The educational activities with which the Institute is associated have continued during the past year. In April, 1934, the third examination in foundry practice and in patternmaking was conducted under the arrangement made by the Institute and other technical societies, and the City and Guilds of London Institute. The number of candidates taking the various examinations and the percentage of passes are shown in the following table:—

Patternmaking—Intermediate Grade.

No. of candidates.	Pass.		Percentage of passes.
	First class.	Second class.	
26	5	10	57.7
Patternmaking—Final Grade.			
19	5	9	73.7
Foundry Practice and Science.			
45	9	20	64.4

The number of approved colleges who submit candidates for the National Certificate in Mechanical Engineering, with special reference to

Foundry Work or Metallurgy, is still small, but an encouraging number of candidates from these colleges, particularly the Central Technical College, Birmingham, has been successful in obtaining the special endorsement of the Institute of British Foundrymen. Thirty-five of these endorsements have been given during the past year, making a total of 103 since the inauguration of the scheme about four years ago.

A year ago, my predecessor, Mr. C. E. Williams, writing in this journal, gave some information about the proposed Degree Course in Foundry Practice which it was desired to inaugurate at the University of Sheffield. The Institute has taken a prominent part in the promotion of this Course; much of the preliminary work has been carried out by a Committee of our members, and these members have personally solicited, with considerable success, promises of annual payments or of special donations from a number of firms and individuals in the industry. The Course actually came into being in October of the past year, and although the number of students is comparatively small at present, doubtless due to the very short time which was available for making the Course known to prospective students, there is every reason to believe that it will fulfil the anticipations of its promoters, and that a large number of students will present themselves in subsequent years.

THE INSTITUTE OF BRITISH FOUNDRYMEN.

OFFICERS, 1934-35.

PRESIDENT:
Roy Stubbs.

VICE-PRESIDENTS:
J. E. Hurst; H. Winterton.

PAST-PRESIDENTS:
R. Buchanan. (Deceased.) 1904-1905.
H. Pilkington. (Deceased.) 1906-1907.
F. J. Cook, M.I.Mech.E. 1908-1909.
P. Longmuir, M.B.E., D.Met. 1910-1911.
C. Jones. (Deceased.) 1912.
S. A. Gimson. 1913-1914.
W. Mayer. (Deceased.) 1915.
J. Ellis. (Deceased.) 1916-1917.
T. H. Firth. (Deceased.) 1918.
John Little, M.I.Mech.E. (Deceased.) 1919.
Matthew Riddle. 1920.
Oliver Stubbs, M.I.Mech.E. (Deceased.) 1921.
H. L. Reason, M.I.Mech.E. 1922.
Oliver Stubbs, M.I.Mech.E. (Deceased.) 1923.
R. O. Patterson, 1924.
J. Cameron, J.P. 1925.
V. C. Faulkner, M.Inst.M. 1926.
J. T. Goodwin, M.B.E., M.I.Mech.E. 1927.
S. H. Russell. 1928.
Wesley Lambert, C.B.E. 1929.
F. P. Wilson, J.P. 1930.
A. Harley. 1931.
Victor Stoble, M.I.E.E. 1932.
C. E. Williams. 1933.

HON. TREASURER:
W. B. Lake, J.P.

TRUSTEES:
F. J. Cook, R. O. Patterson and A. Harley.

GENERAL SECRETARY AND GENERAL OFFICE.
T. Makemson, Assoc.M.C.T., St. John Street Chambers, Deansgate, Manchester, 3.

It is necessary that the amount of money which has been placed by the industry at the disposal of the University of Sheffield should be considerably increased within the next few months, and the Institute will be glad to receive further promises of financial support for the scheme.

The Institute also wishes to commend to the notice, and invite the support of the industry, to a scheme of training which has been sponsored by Mr. J. G. Pearce. This scheme provides for a one-year course in foundry technique in Birmingham, and is open to young men already in the industry who desire to extend their technical knowledge, as distinct from the Sheffield University scheme, which is for matriculated students who wish to take a degree before entering the industry.

Annual Conference

The Thirty-first Annual Conference was held in Manchester during the first week in June, and was attended by a large number of members, many of whom were accompanied by ladies. At this Conference Papers were presented from three overseas foundry associations, namely, the American, German and French Associations. The German Paper was presented in person by the author, Dr. Heinrich Nipper.

Due to the co-operation of many firms in Manchester and surrounding towns, an exceptionally attractive number of works were available for inspection by the members, and the usual social gatherings were arranged for ladies and members.

I would like to take this opportunity of expressing my personal thanks to the Rt. Hon. the Lord Mayor of Manchester, Alderman Binns, for the interest he took in this Conference; to the committee responsible for the arrangements, and particularly to the chairman and secretary of that committee, Mr. A. Phillips and Mr. J. E. Cooke; to the firms who invited members to visit their works, to those who subscribed to the Conference funds, and especially to the very energetic and enterprising ladies' committee.

During the Conference, the ladies of the Lancashire Branch presented to the Institute a badge for the use of the President's wife, to be worn at official functions, and the members of the Branch presented a similar badge to the President. of the Institute. Mr. C. E. Williams, the retiring President, and Mrs. Williams very kindly presented a badge for the use of the Senior Vice-President.

This is a favourable opportunity to place on record the great sense of obligation under which Mr. and Mrs. Williams have placed the Institute, by the thorough and painstaking manner in which they carried out their onerous duties. Mr. and Mrs. Williams have endeared themselves to all associated with the Institute by their charm and courtesy, and by the enthusiastic way in which they entered into the whole of its work.

Relations with Kindred Organisations

We have continued to preserve and to strengthen our relations with other technical societies and also with organisations similar to ourselves in other countries. The liaison provided by the International Committee of Foundry Technical Associations is of great value in breaking down the barriers of nationality and promoting a free interchange of information among the foundrymen of the world.

At the recent International Conference held in Philadelphia, a small party of members of the Institute attended, and received an exceedingly warm welcome from our American friends. We wish to express to our friends in the United States our gratitude for the way in which they entertained our members, placed their technical experience at their disposal, and showed them their foundries.

Employment Register

For some years the proprietors of THE FOUNDRY TRADE JOURNAL have allowed the members of the Institute in search of employment to insert an announcement of their requirements in the journal free of charge.

The requirement of such members have been registered by the general secretary of the Institute, who has thus been enabled to recommend suitable candidates for vacant positions which have come to his notice from time to time. Although it has been impossible satisfactorily to place all members requiring positions, this service has been successful in many cases, and a large number of members have found suitable positions, or, alternatively, have been able to engage suitable members on their staff as a result of this employment register.

The general administration of the Institute has been carried out by its General Council and its Committees, who have held a number of meetings during the year. The new bye-laws which were passed by an annual general meeting some time ago have now been approved by the Privy Council and will come into operation very shortly.

The Institute has long been recognised as the representative technical organisation of the foundry industry. Responsible members of the industry are convinced of the value of membership, and by their active participation in our work are giving to their fellow members the benefit of their experience and knowledge, but we feel that we have a right to expect support from an even greater number of those engaged in the foundry industry. An immense amount of work is carried out by the members for the benefit of the industry as a whole, and such members not only assist in the advancement of the industry, but are enabling themselves to take their place in a rapidly-changing trade. I would ask all who are qualified for membership but who are not yet associated with us seriously to consider the advantages of membership that this Institute will give them.

It is pleasing for me as President to congratulate our honorary member, the Right Honourable Arthur Henderson, P.C., on receiving the Nobel Peace Prize for 1934.

Of the character, energy and ability of our secretary, Mr. Makemson, too much cannot be said. He thinks of nothing but the progress of the work entrusted to him, and he handles every problem which confronts him in a manner which makes it a delight to work with him. Each member of the office staff is a credit to the organisation. The money contributed to the Institute is handled as though it were a trust fund, and the finance committee is never asked to authorise expenditures whose objects have not been carefully analysed as to whether they will be of real benefit to the organisation.

I have never known an organisation in which I felt that those who represent the members in executing their work were functioning with higher ideals or with a more earnest desire faithfully to discharge the trust placed in them.

THE INSTITUTE OF BRITISH FOUNDRYMEN.

Members.

Honorary	20
Subscribing Firms	50
Members	724
Associate Members	934
Associates	104
Total	1,832
Branches	10
Sub-sections of Branches	5
Junior Sections	1
Committees of General Council	4
Technical Committee and sub-committees	9
Branch meetings during 1932	113

The Institute is also represented on several kindred organisations.

Papers presented.

Cast Iron	20
Steel Founding	6
Non-ferrous	9
Moulding, Coremaking and Patternmaking	19
Sands and Refractories	6
Furnace Design and Practice and Fuels	10
General Discussions	7
Organisation	8
Miscellaneous	21
Total	106
Nationalities represented in membership	11
Countries in which members are resident	17

MESSRS. DANIEL ADAMSON & COMPANY, LIMITED, of Dukinfield, in the course of a review of their activities in 1934, mention the following recent orders:—A mixed-pressure turbine-driven turbo-compressor unit for the Wheatley Hill Colliery of the Weardale Steel, Coal & Coke Company, Limited, to the order of the North Eastern Electric Supply Company, Limited, Newcastle-upon-Tyne; a mixed-pressure turbine-driven turbo-compressor unit for the Collins Green Colliery Company, Limited, Warrington; a high-pressure pass-out-type turbo-alternator for Bowden Jackson (Constructions), Limited, Leeds. Also several rotary air compressors of various capacities, and complete steam-raising and power plants.

The Steel Castings Industry in 1934

By F. J. HEMMING (Managing Director of F. H. Lloyd & Company, Limited)

SIR ROBERT HADFIELD in his article last year prophesied a much happier state of conditions in the British steelfoundry industry in 1934, and this has been in some measure realised.

Volume of Trade

The volume of trade during the past year has probably been as high as any recorded during the past decade, but unfortunately figures are not prepared within the industry from which we can confidently establish an accurate return of the total tonnage produced. It is possible, however, to deduce from various reports the approximate tonnage of orders for castings which have been absorbed by British steel foundries. The average monthly production of ingots and castings in 1933 amounted to 583,600 tons and in 1934 this production appears to have reached over 700,000 tons. The output of castings is so small in proportion to these total figures that it does not serve as an accurate guide on steelfoundry activity, yet it indicates the improvement in the ingot trade with which the steelcasting trade moves so much in sympathy. Out of this information, and coupled with it the knowledge of the outputs of a number of foundries in the trade, I do not think an estimate of 80,000 tons for the year 1934 will be very inaccurate. This is an increase of more than 20 per cent. over 1933 and nearly double that of 1932.

These figures provide the reason for the altered state of the industry during the year which is past. It is not easy to single out markets which have been responsible for the increase in activity of the different foundries in various parts of the country. British production is in the main built up on a miscellaneous market and orders are seldom large enough to be very outstanding in character. There has been a notable demand in the South African markets where through various engineers in this country a considerable tonnage of castings has been absorbed into mining-machinery, steelworks and rolling-stock requirements. The Admiralty and the shipyards have also made their contribution. Home railways have provided considerable orders, both through private builders and their own locomotive and carriage shops. New steelworks schemes in Lincolnshire, Northamptonshire, South Wales and Scotland have caused a demand on the steelfoundries through their requirements for new mills, furnaces, lifting gear, soaking pits, and so forth. Probably it would be found that the greater part of the production is finding its way into the home markets, but there is a considerable percentage of castings being exported in British machinery and rolling stock, and there does not seem much doubt that the industry has reaped a marked benefit from the introduction of tariffs.

Tariffs

It will take some time for information to emerge as to the true value of tariffs for this industry, but it is certain that with the extension of this measure of protection, the steelfounders will prove to purchasers in this country that their skill and enterprise is equal to that found anywhere in the world, and that buyers will be more than ready to consider British production in front of any other on performance.

Imports

Whereas in 1931 the imports of steel castings were in the neighbourhood of 500 tons per month, this amount has fallen to a monthly average of less than 100 tons, and it is very doubtful whether any single purchaser in this country has been very much prejudiced on this account. In 1929, when the level of production in the British steelfoundries was about equal to its present output, the imports of steel castings had approached 1,000 tons per month. The distribution of wages and materials in the British market, which the trade might have lost if it had no protection, would have reached

MR. F. J. HEMMING.

between a quarter and half a million sterling. Whilst only a drop in the ocean, this is, in my personal opinion, one of a group of causes in the foundation of confidence which is being restored. With the opportunity presented to write this article reviewing the trade during the past year, I feel that perhaps the most vital concern of the trade is the question as to whether it is possible to establish co-operation to cure the ills created by the sudden war-time expansion and aggravated by the post-war depression.

Co-operation

Co-operation is a national essential, so that information can be provided to enable the trade to develop on rational lines. It is equally essential for the trade to attain a fair and reasonable price level for its products, because wages must ultimately be affected by the prosperity or adversity of a trade which bears a very high wage cost. Few trades are faced with a problem as intricate as this has proved to be on many occasions. It is very difficult to bring to light the reasons for repeated failure to provide for united action, but if success were attained in this direction, it would be possible for manufacturers to rationalise their foundries in given directions. Whether or not the trade is on the eve of success in this respect, it would be difficult to forecast, but the repeated attempts at co-operation have resulted in better understanding of individual problems, created friendships and lessened "internicine" warfare, which was the stock phrase applied to steel castings a year or two ago.

Price Fixation

Every founder would like to be able to establish a price level for every article in the trade and maintain it. New trades have the same justification for desiring a controlled price. Practically half of the cost of the casting lies in labour, which is purchased, or should be purchased, at rates equal throughout the trade. Freight on materials is governed by railway companies, and as several tons of material are required to make a ton of castings, this item is of no mean importance. Pig-iron is controlled by a group of manufacturers. The bulk of fuel is at controlled prices. Electrical power is fixed by a local body. Bank interest (if any) is at a fixed level. If, then, the founder is the subject of fixed price in 90 per cent. of his own commitments, surely there are justifiable grounds for pursuing a policy of price fixation. It sounds and looks satisfactory on paper, but when it comes to the nomination of price on types of castings by weight and intricacy, the problem starts and, whilst it is possible to define a certain portion of the trade, yet there must always be a very large margin left where knowledge of cost and courage in sales are the two basic factors in success. Much has been written and said on this subject in countries other than our own, and all of it pivots on cost knowledge. If the trade possessed this, there would be little to criticise in the profit-and-loss account on the present volume of trade available. Knowledge of cost is a very wide term, and is seriously affected by the volume of trade.

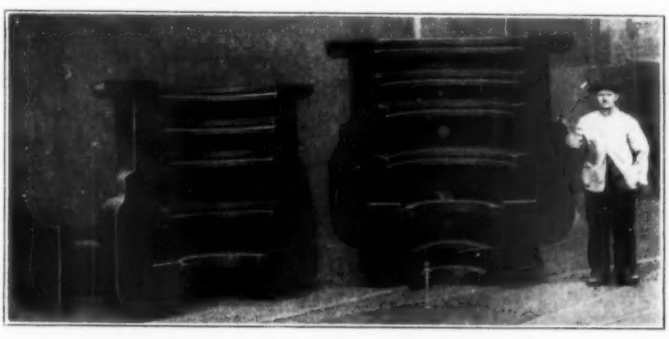


FIG. 1.—STEAM TURBINE CASING SUPPLIED IN TWO HALVES, ROUGH MACHINED. APPROXIMATE WEIGHT 4 TONS 10 CWTS. EACH HALF. MADE BY MESSRS. F. H. LLOYD & COMPANY, LIMITED.

In April, 1932, the attempt at price fixation and its collapse caused a resultant orgy in price cutting, and it is only by a slow process that the evils of this can now be remedied. Mistakes in estimating are bound to occur, either from ignorance or misfortune, but if all manufacturers

had the courage to rectify a price which had previously netted them a loss the trade would have gained a much healthier state than is the case at present. In a large number of cases prices are still below the possibility of productive cost under ideal conditions, and the responsibility for providing a remedy lies in the hands of the trader himself. The quickest remedy seems to me to be that individual founders should take advantage of the larger volume and adopt a higher standard of courage in their selling efforts than is at present being evidenced, because mass courage of this character can make an enormous difference to a trade. The alternative to this is a price list which every member of the trade will agree to respect. This, however, cannot be done on each and every casting where modified patterns, thicknesses, etc., are always creating insurmountable difficulties, but the trade might very well be strengthened where the position is clear between the purchaser and consumer, and perhaps in 1936 a considerable advancement will be witnessed in this direction.

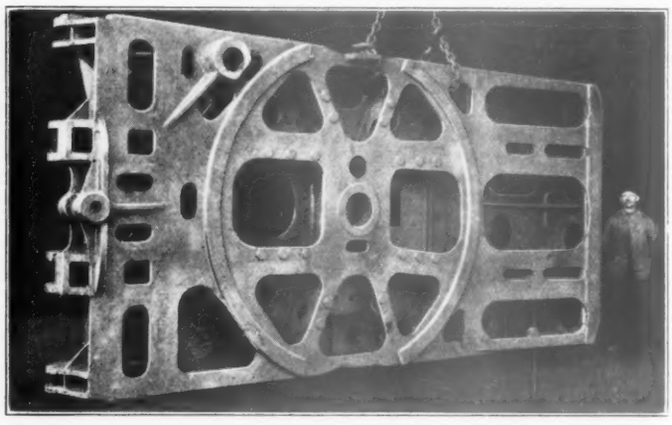


FIG. 2.—REVOLVING BEDPLATE CASTING FOR THE SUPERSTRUCTURE OF A THREE CUBIC YARD CAPACITY RUSTON-BUCYRUS EXCAVATOR (WEIGHT 11 TONS), ALSO MADE IN THE AUTHOR'S WORKS.

Welded Structure

Last year attention was called to the competition which has sprung from the welded structure. It is still too early to be able to give any specific information as to the extent of this competition and its effectiveness. Some work has disappeared and other work has come back to the steel foundry. Personal experience is that engineers are developing a more cautious attitude towards welding activities than a year ago. The same degree of rigidity cannot be obtained, and the author is of the opinion that there will be a distinct swing towards the casting in engineering problems where severe strains and consequent rigidity is required.

Technical Advancement

The steel foundry trade is not idle. Acceptance of keener specifications is frequently being taken. I am informed that rotary furnaces are being used and their use being extended. Pulverised fuel for annealing furnaces is being utilised and developed in a number of cases. High-speed grinding has progressed and would probably be found to have increased in most foundries during the past twelve months. The larger volume has led to the installation of larger and more up to date moulding machines in several foundries. Considerable advance has been made in the use of synthetic sands and lining refractories. In conclusion, I think the situation for 1935 has great promise. At the present time the British market is mainly responsible for the improved conditions which prevail in the heavy industries. 1934 has been a time of restoration of equipment, and it is to be hoped that "confidence" which has been the foundation of British recovery will have spread itself further afield and secured freer exchange of world production. The year 1935 will then see a marked improvement in the steel foundry industry by means of an active export market which it needs to consolidate its position.

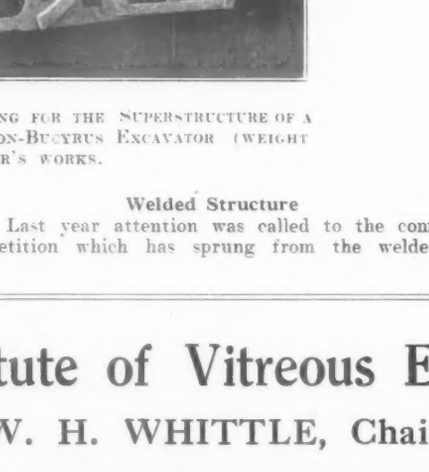
The Institute of Vitreous Enamellers

By W. H. WHITTLE, Chairman

WHEN a few enthusiasts called a meeting of people interested in vitreous enamelling at the Birmingham section of the British Industries Fair, they had but little idea that before the year ended an Institute having about 150 members would be functioning just as smoothly as the well-established scientific associations and giving a technical service comparable in every way with similar technical bodies. This has not been accomplished without much hard work, and the Institute has been particularly fortunate in its choice of officers. For its President, the choice of Dr. Mellor, F.R.S., could not very well have been bettered, as his erudition and personal charm are recognised throughout the scientific world.

The vitreous-enamelling industry became technically conscious of the existence in a whirlwind fashion at its first annual conference held at the Grand Hotel in Birmingham. Here there assembled from all parts of Great Britain a large concourse of people interested in the technical development of vitreous enamelling. Mr. L. S. Amery, P.C., was the principal guest at the banquet and full support was accorded by the civic authorities of Birmingham. The guests played a very important part in the launching of the Institute, and I am more than grateful for the help they so willingly accorded. The thanks of the Institute are also due to the Parkinson Stove Company for allowing their works to be inspected and for the hospitality they showed.

The winter session is now half finished and already about a dozen meetings have been held in London, Birmingham and Manchester. The interest displayed has been extraordinary. Raw materials, processing, casting and sand-blasting have been discussed at length. A few "teething troubles" have been experienced, but with the technical advancement of the industry as the basic principle in the minds of every one of my colleagues, all difficulties have been overcome on this basis.



MR. W. H. WHITTLE.

For the second half of the session. Papers by recognised leaders of thought are to be given on cast iron for enamelling, various aspects of silicosis, and problems in processing.

These details will, I am sure, indicate the value of the Institute to the industry and particularly to those in search of technical knowledge. To those firms and persons who have not already joined, I am convinced that it is worth their while to do so, and on behalf of the Council I extend to them a hearty invitation to assist in what is undoubtedly of paramount advantage to the industry as a whole.

THE INSTITUTE OF VITREOUS ENAMELLERS

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The Non-Ferrous Foundry Industry in 1934

By JOHN ARNOTT (Chief Metallurgist, G. & J. Weir, Limited, Glasgow)

AT the outset it may be said that the past year has not witnessed anything outstanding in metals, plant or processes. It has been rather a time of consolidation and normal development. The improvement in trade, definite though not spectacular, has been reflected in the foundry industry and has produced a distinctly better atmosphere. The partial return to what we may consider normal times has brought its own problems. It has not always been possible to replace exactly or quickly staff arrangements which were upset in the recent lean years, and on the operative side, the resumption of work by men who have been away from their trade for long periods has been sometimes a trying experience to both the employers and the men themselves. Some of the finer touches of pattern drawing and coresetting do not come back immediately the moulder dons his overalls. Many men have left the industry and adopted other callings, whilst the youth of these times is not exactly rushing to follow up moulding as a trade. As a result, it is not surprising to learn that in some districts there is, if not an actual shortage, at any rate no excess of skilled moulders.

Market values for the non-ferrous metals have not changed much during 1934. There was a slight fall in the price of copper toward the end of the year, but on the whole the comparative steadiness of metal prices has been a satisfactory feature to an industry in which the cost of raw materials forms such a large proportion of the selling price.

Gun-Metals

Turning our attention to metals, we find that the gun-metal series, the backbone of the foundry industry, remains unchanged as far as composition is concerned. Various phases of the technique and metallurgy of gun-metals were the subjects of Papers by Bailey, Logan, Rowe and Saeger respectively. These Papers indicate the sensitiveness of the copper-tin alloys to melting conditions, casting temperature, rate of cooling, mass, etc. Each successive investigation only emphasises the fact that variations in these factors may, and do, result in large disparities in the strength and soundness of the resulting castings. Yet the composition of the gun-metal series has remained in most cases unchanged. Surely the time is ripe for some real advance, for some method of stabilising these alloys and of ensuring greater uniformity and soundness. Improvements in some direction or other have resulted from the use of additional alloying elements in cast iron, brass, steel, light alloys, in fact to nearly every main group of alloys. It is therefore surprising that, beyond phosphorus and perhaps nickel, none of the rapidly-growing number of less common elements has yet found a sphere of usefulness in gun-metal. When we think of the strides made in the last ten years in cast-iron technique, of the uniformity now obtainable in varying sections, and throughout heavy sections, we are encouraged to hope.

An Automatic Furnace Required

There is complete unanimity about the need for avoiding high casting temperatures, and in most up-to-date foundries a certain amount of temperature measurement is carried out. The ideal would be to have a melting furnace with automatic temperature control, or at any rate an arrangement to give a warning signal when the metal had reached the desired temperature. This may seem rather Utopian, yet the advance in annealing furnaces indicates the possibilities; we now have gas-, oil- and electrically-heated furnaces available with automatic control, some for temperatures up to 1,300 deg. C., and some with atmosphere control and time switches. The actual control gear can be obtained to-day; all that is wanted is the pyrometer part of the business, and since moderate time lag can be permitted, this should not be an insuperable difficulty.

In C. M. Saeger's research, the melts were all made in a high-frequency induction furnace, where no gases are introduced by the method of heating, yet low densities and strengths were found in the bars cast at high temperatures. Hence there does not seem to be much prospect of avoiding porosity by a change in the melting unit itself, and the best we can do at present is to attend to temperature.

MR. JOHN ARNOTT.

Nickel-Bronzes

The nickel-bronzes, which may be considered as akin to, and extending the range of the gun-metal series, continue to find new applications. By raising the hardness from round about 80 up to 160 Brinell and over, without losing the general foundry characteristics of the gun-metals, these nickel-bronzes are meeting the need for metals to work along with some of the newer types of steels.

Leaded bronzes are the only group suitable for certain parts such as slide valves, glands, packing rings and thrust blocks which have to work against other metals under high speed and/or high pressure with little or no lubrication in the ordinary sense of the word. The leaded nickel-bronzes retain this anti-seizing property at a higher range of hardness, and have been found to stand up to exceptional conditions with complete absence of scoring and with the minimum of wear. Some fine work by Wise and Ease, of the International Nickel Company, was included in a Paper to the American Institute of Mining and Metallurgical Engineers. This work provides a very useful survey of the alloys up to 20 per cent. nickel and 10 per cent. tin. Some of the series responded very well to heat-treatment, and in the treated state had remarkable properties. For example, one melt with 8 per cent. tin and 7.5 per cent. nickel gave a T.S. of over 40 tons per sq. in., with over 15 per cent. elongation and a Brinell hardness of about 170. Brass foundries as a rule have not adopted heat-treatable alloys to any extent outside of the light alloys. This is quite understandable because there has not been a very insistent demand for the heat-treated castings, and also because few foundries have suitable furnaces for the treatment. Some of the bronzes covered in this research had good strength in the as-cast condition, though generally the ductility was less than that of the heat-treated series. The Paper gave valuable information on melting procedure and the effect of additional elements. It is of interest to note that barium was used as a final deoxidiser.

The Brasses

In the realm of the brasses, no metallurgical novelties fail to be recorded. The restart of the Cunarder, "Queen Mary," resulted in the casting of the largest propellers ever made, and probably also the heaviest casting ever cast in manganese brass. It is doubtful if many heavier castings have been made in any non-ferrous metal. The eight propellers each weighed 53 tons as-cast, and 35 tons when finished. It is gratifying that at this time, when our supremacy in shipbuilding and many other things is being challenged, Britain still retains the lead in this branch of foundry and engineering craftsmanship.

Light Alloys

In this field the novelty of the year was the appearance of a new series of aluminium alloys, bearing the trade name of Ceralumin, and developed by J. Stone & Company, Limited, Deptford. The series covers both sand and chill castings, and the alloys develop their full strength after a heat-treatment of the usual type. It is claimed for the series that they have good foundry qualities. It is noteworthy that this feature has received much more attention in the post-war period than in the early work on light alloys; and that parallel with the increase in mechanical properties obtainable, there has been a big improvement in freedom from hot shortness and from shrinkage troubles generally. The particularly interesting feature in the Ceralumin group is the inclusion in their composition of up to 1 per cent. of the element cerium. This is probably the first use of cerium in a commercial casting alloy, and adds yet one more to the fast-growing list of rather uncommon elements which are coming into foundry use. In this connection, it might be added that a recent D.T.D. Specification, besides giving limits for main constituents, gives a list of six permitted elements, comprising Na, W, Cr, Co, B and Ca. Soon the "compleat foundryman" will require to have a good knowledge of the periodic table, and the chemist's lot will not be a happy one. Less has been heard recently of porosity in aluminium castings and methods of treatment of the molten metal, which were the subject of much work in previous years. From this we take it that the troubles are either cured or endured.

Magnesium Castings

The manufacture of magnesium-alloy castings has not yet spread much beyond the few firms who have done the pioneer work. When figures for the year's output are available, they may be expected to show a continued rate of increase. Credit must be given for the excellence of some of the magnesium-alloy castings which are produced to-day. The accuracy to pattern and the quality of skin, possibly accentuated by the coloured finish which is now standard, are of a very high order. While speaking of surface finish, it might be remarked that the "save

the surface" slogan adopted for publicity for paints and varnishes seems to be spreading to the castings trade. The activity is seen in recent work on anodic oxidation of aluminium, chromate finish on magnesium alloys, and in the demand for finer surfaces on articles to be electro-plated. The urge for a better skin on castings is likely to benefit foundries, because it would lessen the appeal of alternative processes such as drop forging.

Plant

In melting equipment, though there have been no major developments, there has been considerable activity. Some of the larger foundries find that the increasing number of different alloys necessitates a greater number of melting units of relatively small capacity. Batteries of 300- to 600-lb. furnaces are taking the place of large reverberatory furnaces. The advantages of oil melting have weighed heavily with those responsible for the choice, and there is no doubt that with oil-fired crucible tilters of say 400 lbs. capacity, the widest range of non-ferrous work can be undertaken. Oil-fired rotary furnaces and forced-draft coal or oil-fired hearth-type furnaces are being adopted especially for ingoting of borings and bulky scrap. Since centrifugal casting is largely a question of mechanism, it might be mentioned here that a casting weighing 18 cwts. has been made in a vertical axis mould. Makers of equipment report a revival of interest in plant generally. Even small foundries are recognising that mechanical help in sand preparation and distribution is a paying proposition, and that substantial economies can be effected through the newer types of moulding, core-making and core-blowing machines, and also by the more efficient methods now available for drying moulds and cores. From America there comes news of a completely-mechanised brass foundry, belonging to one of the railways. The description of this foundry is of intriguing interest, for both in size and material the range of product is wider than might be at first envisaged in a rail-road foundry. The melting is done in a set of rotating electric furnaces and the lay-out includes separate conveyor systems for the sorting of scrap, delivery of sand, pouring of moulds, and emptying of castings. A Holley permanent-mould machine is also installed.

It would require an encyclopædic knowledge not claimed by the writer to summarise a year's progress in an industry which makes candlesticks and ships' propellers, mascots for motor-cars and tuyeres for blast furnaces.

It might be an apt conclusion to quote from a paper by Mr. A. Logan in the spring of the year. He said, "The problems of the present were the problems of the past. Nowhere more than in foundrywork is it realised that knowledge is not accumulative."

As an illustration of one phase of this, we may find a foundry capable of producing excellent crankcases in some of the new light alloys, yet failing occasionally to make sound castings of plain gun-metal liners.

It is a healthy sign that, along with the development of new alloys and improved methods, there has been, in recent years, a more serious study of some of the fundamental or elementary problems connected with the industry.

The Belgian Foundry Industry

By J. LÉONARD (President of the Association Technique de Fonderie de Belgique)

WHEN Mr. V. C. Faulkner, the Editor of THE FOUNDRY TRADE JOURNAL asked me to pen a few lines on the economic and technical situation now existing within the Belgian foundry industry, I could not very well refuse this honour on account of the extremely friendly relations established between us during the meetings of the Foundrymen's International Technical Committee.

It is trite to repeat that Belgium, a quite small country carrying a heavy density of population, highly industrialised, unbalanced in its natural and unfortunately vital resources, cannot exist except by doing something to counterbalance its imports.

It is, perhaps, neither good policy, nor even courteous, to remind readers of a British journal, for which country we have a very sincere friendship, that the scale of the tariff walls has deprived us of markets which until recent years were supplied from Belgium. I neither ignore nor underestimate the national necessities of other countries; moreover, I offer no criticism. I objectively recall one fact which has quite brusquely and completely thrown the whole of the activity of our nation out of equilibrium. The same political economy is practised in most countries and our situation has become critical.

This lack of balance is, however, not definitive; we ourselves are forced to replace the fading markets and, taking everything into consideration, Belgium is not the country where the crisis is most highly developed. It has registered in recent months certain improvements due in a large measure to the organisation of international cartels and higher price levels. Further improvement was due to the elimination of untoward competition, which has no other result than the disorganisation of the markets, the lowering of prices and chaotic conditions within the factories.

The Belgian foundries have suffered from the above causes. But they have failed to profit from the organisation of selling syndicates designed to bring a little moderation in price-cutting wars such as exist in neighbouring countries and which permit of high internal prices and dumping abroad. We suffer quite a little on this account, and Belgian foundries undoubtedly lose much through their lack of co-operation on the commercial side, and allow foreign markets to go by the board.

I have only available the production figures for the output of steel castings, which have been abstracted from the "Revue de Travail," the official organ of the Belgian Ministry of Labour and of the Social Welfare. They are set out later, starting from 1932. The 1934 production will be 10 per cent. less than 1933 and 4 per cent. less than 1932.

MR. J. LÉONARD.

What comment do these figures call for? The prosperity of a country does not evade a common law; it shows peaks and valleys. Belgium was dragged into the events which took place from 1914 to 1918, and the graph of the variations of its activity was depressed into negative values. The post-war period permitted it to re-habilitate itself. After some ups and downs, the curve rose in an exaggerated manner following the general fever which attacked the entire world. The repercussion which followed it is a function of the steepness of the curve, but Belgium has faith in its destiny and neither economic difficulties nor international political circumstances will prevent us from making the necessary recovery. It will be long and difficult, but it will come about. The editor asked me to review the technical situation within the foundry industry. To reply is somewhat delicate for the writer as President of the Belgian Foundry Technical Association, the principal part of whose work has been the formation of nuclei for the Belgian foundry industry. Thus it is not for him to pass judgment on the work in which he participated. It is, however, possible for him, and perhaps even a duty, to tell of the influence which they have had on the smooth running of foundry technique and science, together with the co-operation with the various foundry technical associations.

Monthly Production of Belgian Steel Castings since 1932.

Output, in metric tons.	1932.	1933.	1934.
January	4,570	4,130	4,840
February	4,260	4,000	3,410
March	4,440	5,480	4,070
April	4,950	4,360	3,670
May	4,170	5,290	4,100
June	4,630	4,950	4,210
July	3,330	4,380	3,830
August	3,510	3,570	4,270
September	3,730	4,470	4,010
October	3,640	4,570	—
November	4,590	4,570	—
December	4,960	3,730	—
Total	50,710	53,500	48,000*

* Estimated.

It is possible to make a comparison of the present situation with that of ten years ago. The progress realised is enormous. The major part of the success is due to co-operative work and the application in industry of the results of research. My opinion on this subject is clear cut. These technical associations are in the main useful. Like so many others, I personally owe to them much of my technical knowledge. This is a sufficient reason for Belgian efforts to be examined in the light of the intense development of science and its very complete application to the domain of the actual works.

Research for the Foundry Industry in 1934

By J. G. PEARCE, M.Sc., M.I.E.E., F.Inst.P. (Director of the British Cast Iron Research Association)

WITH respect to the work of the British Cast Iron Research Association, it is not necessary to recapitulate details given in the last annual report, published in the issue of THE FOUNDRY TRADE JOURNAL for November 8, 1934.

Moulding Sands

In parallel with the report referred to last year on recommended methods for sampling and analysis of cast ferrous metals and alloys (issued as Special Publication No. 1), the Association has published[1] as Special Publication No. 2, available to all interested, recommended methods for testing and control of foundry moulding sands, this being in effect an extended edition of the report originally issued in 1930. Several important changes have been made. The compression test is now exclusively recommended as the standard strength test. The permeability apparatus has been modified to permit the use of air to meet the requirements of foundries not supplied with gas. The standard A.F.A. test-piece can also be tested in the standard B.C.I.R.A. apparatus for both strength and permeability if a suitable core-box is provided. The report gives methods of sampling, milling, ramming, determination of moisture, mechanical analysis for grading the grain size, strength, permeability, refractoriness and chemical analysis, with appendices on the size and method of preparation of sand test-pieces and representative results for strength and permeability on various sands in actual use in representative ironfounding areas. As far as possible, in another appendix the results between various test methods are compared and there is a final section upon recommended apparatus for testing sands, with suppliers and prices. It is illustrated by photographs and diagrams.

Modern Cast Irons

The author, in a Paper on modern cast irons in chemical engineering, to the Chemical Engineering Group of the Society of Chemical Industry,[2] briefly described improvements in mechanical properties, corrosion resistance and heat resistance which have taken place in cast iron during the past few years. The improvements in mechanical properties will be familiar to most readers of the Journal, and, with respect to corrosion resistance, reference was made to the excellent corrosion-resisting properties which cast iron normally possesses compared with other ferrous materials not specially made to resist corrosion. This is illustrated by the work of the Committee of the Institution of Civil Engineers for 18 years past, on the deterioration of structure in sea water, and also the work on soil corrosion of pipes studied over a period of ten years by the U.S.A. Bureau of Standards, a brief account of which appears in the B.C.I.R.A. Bulletin for October, 1934. Reference is made to the improvement in corrosion resistance by using low alloy additions of nickel and chromium and also the high-silicon acid-resisting irons and the austenitic irons. Incidentally, according to "The Foundry," March, 1934, 3.5 per cent. molybdenum and 1 per cent. nickel have been added to high-silicon iron to produce metal suitable for resisting acids where ordinary high-silicon iron is unsuitable, such as in HCl. Among heat-resisting irons, the developments referred to are well known, with the possible exception of the high-chromium irons containing about 35 per cent. chromium.

Corrosion Resistance

The suggestion is made in the Paper that, in view of the difficulty of digesting masses of figures from corrosion tests, with varying concentrations, temperatures and media, the German plan be adopted of classifying results on the following lines:—

Loss in weight gm. per sq. metre per hour.	Resistance.
Below 0.1	Completely resistant.
0.1 to 1.0	Satisfactorily resistant.
1.0 to 3.0	Fairly resistant.
3.0 to 10.0	Slightly resistant.
Above 10.0	Non-resistant.

This table is, of course, prepared for corrosion-resisting alloys, and marked improvements can be obtained in the life of castings subject to corrosion, such as by low nickel addition, of decided economic advantage, and yet which would not suffice to enable them to be transferred to a higher class in the above table. This could be met by expanding the last grade. Strictly speaking, irons so grouped should be tested by a standard corrosion test. No difficulty would be met in evolving such tests, as many types are used in laboratory exploration of corrosion resistance, but they should be supplemented by tests simulating as closely as possible actual working conditions. The problem of corrosion is a very pressing one. Reference was made last year to the important conclusion arrived at from tests made by the Institution of Automobile Engineers, that corrosion was a factor in wear under lubricated conditions. This has, during the year, been further confirmed.[3] It has been found that wear is accelerated by carbon dioxide in conjunction with moisture, and by sulphur in the fuel, although in high-grade petrols this is not a factor of marked influence. Upper cylinder lubrication does not appear to affect wear very materially.

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The same is true of dry conditions, and the effect of corrosion on fatigue strength is now well established and widely recognised. There is great similarity between the processes of corrosion and breakdown due to heat, both growth and scaling. The latter proceeds at elevated temperatures, but the former proceeds at atmospheric temperatures as well. The graphite in grey cast iron is thus an important factor in corrosion, as it is in growth, since it provides the channels through which oxidation may go on. These graphite cavities, also, provide notches of the kind which, in other materials, lead to mechanical failure under alternating stress. The reason why cast iron has fatigue properties uninfluenced, or only little influenced, by artificial notches, like holes, corners and re-entrant angles in a design, is probably due to the fact that it is already highly notched through the graphite cavities. Thus, cast iron is relatively better in fatigue than the more homogeneous irons and steels. Incidentally, work carried out on fatigue increasingly shows a relation between the endurance limit in fatigue and tensile strength. This ratio is higher with alloyed than with plain irons. Since fatigue failure is primarily a notch failure, due either to a notch effect created by the design or by some impurity or inclusion or heterogeneity in the material, or arising as a consequence of the effect of stress, there is a sense in which any failure in cast iron may be termed a fatigue failure. The fractures obtained from fatigue failures in cast iron and ordinary static failures are very much the same.

New High-Endurance Ratio

Pfannenschmidt[4] reports that the endurance ratio (ratio of endurance limit to tensile strength) is 0.45 to 0.50 for straight cast irons and 0.55 to 0.65 for alloyed cast irons (rising in one case to 0.8). The fatigue strength appears to be increased if the surface of the metal is polished.

In a Paper to the Iron and Steel Institute,[5] the present author separated in the ordinary transverse test that part of the deflection which is permanent, remaining after the load is removed, and that part which is elastic, which disappears on removing the load. The relative proportions of these two components of the deflection suggested the possibility of obtaining by comparatively simple methods, an estimate of the elastic modulus of grey cast iron, which was shown to vary with size of bar much in the same way as transverse rupture stress. It was also shown that impact strength changes in a way which would be expected from changes in resilience. It would appear that it is the plastic component of the deflection which enables an iron to resist shock.

Cast Crankshafts

One of the most remarkable developments has been that of the cast crankshaft, as opposed to the forged crankshaft, for automobiles. This development originated in the United States and is understood now to be standard practice on the Ford car. The analysis adopted is a low-carbon cast iron which has been given as follows:—Total carbon, 1.25 to 1.4; silicon, 1.9 to 2.10; chromium, 0.35 to 0.40, and copper, 2.50 to 2.75 per cent.

The material is heat-treated after casting. Nickel, chromium and molybdenum irons are also being used for camshafts and crankshafts, but authoritative information has not yet appeared in printed form. This material not only wears better, but is rather simpler to manufacture, and is not so liable to develop dangerous stresses in

service on account of what is termed the damping capacity of cast iron, that is, the ability to absorb stresses set up under vibration.

Alloyed Irons

Work on alloyed irons and their properties is proceeding in nearly all industrial countries, and a large number of Papers have been published during the year. Of these, one of the most interesting is that of Taniguchi on alloyed chilled-iron rolls.[6] The effect of some 15 elements was studied on surface hardness and chill depth and nickel is the most powerful element for increasing hardness, and chromium in conjunction compensates for reduction in chill depth. It was found that Shore hardness figures of over 90 were obtained within the range, nickel 3.3 to 4.3 per cent. with chromium 1.2 to 1.6 per cent.; and also within the range nickel 3.9 to 4.8 per cent. with chromium 0.2 to 0.5 per cent. Mr. W. T. Griffiths[7] has also written a Paper on this question which has been published in the Journal.

Slag Effects

Research has recently been turning to the influence of slag particles in molten iron and several recent Papers have appeared.[8] The second Paper mentioned is mainly concerned with the deliberate addition of mill scale with and without glass, after the melting slag had been removed. In the first Paper it is suggested that graphite formation is influenced by finely-divided iron-silicate slime, which can be removed either by superheating or by an active deoxidiser. The silicate slime also seems to affect the chilling property of the metal. In these respects the slag particles are offered as the main reason for the difference between coarse- and fine-graphite irons, a difference hitherto ascribed to graphite nuclei, the irons with the slag present solidifying with coarse graphite and the irons freed from it solidifying with fine graphite. This point is referred to more fully below.

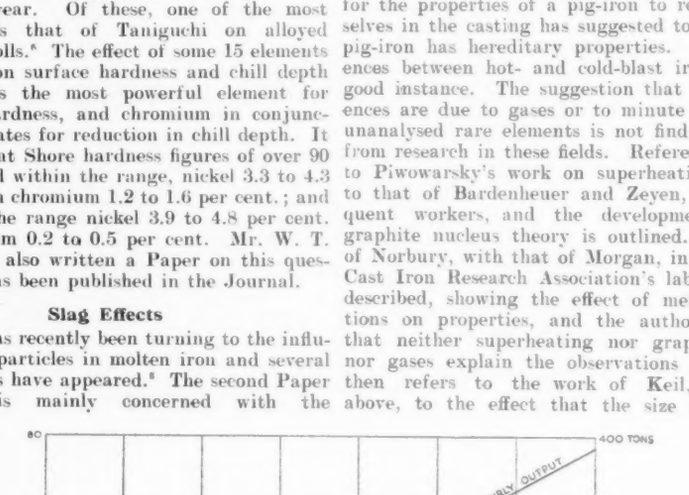

FIG. 1.—BALANCED-BLAST CUPOLAS INSTALLED AND UNDER CONSTRUCTION AT JUNE 30 IN EACH YEAR.

Enamelling

Those who visit exhibitions, such as the British Industries Fair, and virtually any trade exhibition where domestic products are shown, can have little doubt of the enormous spread of enamelling processes for cast iron and the advance of this industry has been recognised by the formation of The Institute of Vitreous Enamellers. Considerable research, however, is required before the vitreous enamelling of cast iron will be put on a sound and satisfactory basis.

Malleable Cast Irons

With respect to malleable cast iron, the principal developments in this country have been the adoption by some firms of rotary pulverised-fuel furnaces for melting and permitting modifications to the annealing cycle, which reduce annealing time and cost, and hence time of delivery. The short-cycle processes which have been developed in the United States and Germany do not appear to have made very much headway in this country, probably on account of the elaborate furnace equipment required.

Constitution and Properties

On the theoretical side, while considerable modifications in point of view have taken place, there has been no marked change, and the present position is admirably summed up in several important respects in an article on heredity in cast iron by Gillett.[9] The tendency for the properties of a pig-iron to repeat themselves in the casting has suggested to many that pig-iron has hereditary properties. The differences between hot- and cold-blast irons form a good instance. The suggestion that such differences are due to gases or to minute portions of unanalysed rare elements is not finding support from research in these fields. Reference is made to Piwowarsky's work on superheating, as also to that of Bardenheuer and Zeyen, and subsequent workers, and the development of the graphite nucleus theory is outlined. The work of Norbury, with that of Morgan, in the British Cast Iron Research Association's laboratories is described, showing the effect of melting conditions on properties, and the author concludes that neither superheating nor graphite nuclei nor gases explain the observations made. He then refers to the work of Keil, mentioned above, to the effect that the size of graphite (which marks the main distinction between a superheated and a non-superheated iron) is mainly due to the presence of a fine silicate slag, of sub-microscopic character. It is suggested that irons containing this slime give coarse graphite, and without it the graphite is fine, or what Norbury calls supercooled.

Ingot Moulds

An interesting idea has been patented (No. 410,898), due to R. W. Bailey, for promoting heat flow from a solidifying ingot in an ingot mould. Ordinarily, the ingot separates quickly from the mould, and the thermal gradient is interrupted by the air gap. This gap is filled under pressure by a low-melting alloy, and thus the metallic continuity of mould and ingot is maintained.

Nitrogen Hardening

Mr. J. E. Hurst has reported that the nitrogen-hardening process has been applied to austenitic irons, the thermal expansion of which enables them to be used readily in conjunction with aluminium alloys.

Melting Practice

The balanced-blast cupola continues to develop satisfactorily, as will be seen from Fig. 1, and during the year the writer described this development to the French Association Technique de Fonderie. The number of balanced-blast cupolas in commission and under construction now exceeds 60, and at the date of writing is 68. Furnaces have been successfully started in Australia and India, as well as in this country. It is used for practically all types of castings and has been adopted by about 16 per cent. of the members of the British Cast Iron Research Association. The effect of length of run on economy has been obtained for a 36-in. cupola, using heavy scrap to the extent of 40 to 50 per cent. of the charge, and melting iron of medium-phosphorus content and delivering it at 1,370 deg. C. to 1,390 deg. C. On a 3-hr. melt the percentage of coke required, including bed coke, less coke recovered fit for use, was 8.85 per cent., and on 4-hr. and 5-hr. runs the figures were 8.40 and 8.13 per cent. In terms of metal to total coke ratio the figures were 11.3 to 1, 11.9 to 1 and 12.3 to 1. These figures do not appear to vary much with size of cupola and, of course, apply only to the type of metal and coke being used in this particular case. In other cases they may be greater or smaller according to conditions.

In a note on cupola melting losses the author showed that the loss of iron in slag under reasonably good melting conditions was of the order of 3 cwts. in every 100 tons of metal melted, assuming that 2 to 3 tons of slag are produced for every 100 tons of metal melted. In a note on foaming slag, H. Cowan and C. Rowley have suggested that foaming slag is not a mere agitation, but an effervescence due to gas forming within the slag itself, probably arising from a rarely occurring and acutely oxidising condition, particularly in the presence of excess air supply and low coke bed. It is also suggested by them that glass or sand added to the furnace would take into solution the excess iron oxide present and thus diminish the trouble when it occurs.

Foundry Education

Two Papers have been presented by the author during the year on the projected British Foundry School.[10] In this scheme it is proposed to establish a small, but highly specialised school for men who have entered the foundry industry and obtained practical experience within it and who are marked out by previous training and ability for higher responsibilities in it. It is proposed that the course shall occupy one year, full time, and will comprise the most advanced instruction with respect to foundry progress and technique that is available. The scheme has received the favourable consideration and financial support of a number of scientific and technical institutions and trade associations concerned with the industry, and further developments are anticipated shortly.

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THE SKINNINGROVE STEELWORKS, Saltburn, were closed on Saturday, December 22, until January 3. The stoppage was dictated not by any slackness of work, but owing to the urgent need of repairs. During the brief cessation of operations the large Talbot steel furnace was reconstructed and other necessary repairs carried out on the rolling mills and other sections of the steel-smelting and fabricating plants. It is expected that the Talbot furnace will be ready for operation again on January 5. The blast furnaces will, of course, continue without interruption.

Recent Developments in the Mechanisation of Foundries

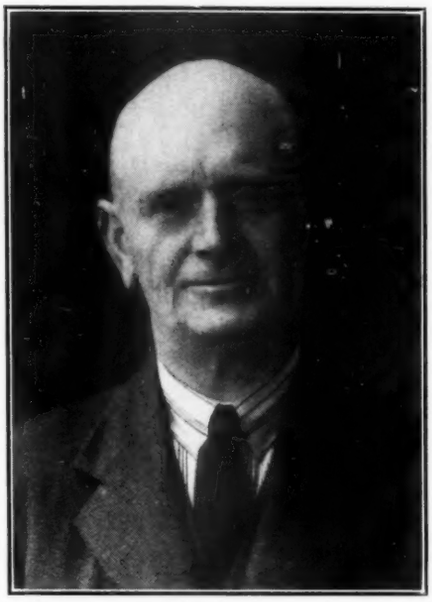
By R. SPRIGGS (Herbert Morris, Limited)

Recent developments in the mechanisation of foundries have been so rapid that continuous casting plants put down as recently as five years ago are already obsolete. Plants produced during the past year, and those to be installed this year, disclose vast improvements in general lay-out, in detail design, and in productive efficiency. In fact it can at last be said that the foundry engineer has mastered the needs of the British foundry trade.

As a prominent example, consider mould conveyors. The old slipper plate type, requiring a 15-h.p. or larger motor to drive it, has been superseded by mould conveyors capable of doing better work with less maintenance cost, and requiring less than a third of the horse-power for driving. The first cost is also less, in spite of these striking improvements.

Shake-out Improvements

Important improvements have been made at the knock-out section (aptly named, indeed, in some cases); "shake-out" is perhaps a better term. This was the most arduous job in a continuous plant, and there is still room for further improvement. One form of shake-out which has proved very successful is illustrated in Figs. 1 and 2. The mould conveyor in this foundry is used for both box and boxless moulds. The latter are automatically tipped off the conveyor, while the former are drawn off on rollers before arriving at the tipping point. All sand and castings are automatically discharged on to the knock-out grid, which is mechanically jolted, the sand going through the grid and the castings sliding down into a suitable container. The moulds travel on boards along the mould conveyor, the automatic tipping plates of which are fitted with curbs which retain the boards on the conveyor as the moulds slide off. The rings are picked off at the shake-out and replaced on the mould-conveyor plates. This arrangement eliminates most of the heavy manual labour, and is excellent for small work. It should be noted how the arrangement of conveyor brings the shake-out grid well above the floor, thus saving the men from stooping down to pick out the rings for return to the mould conveyor. This allows also for the castings being discharged on to a bogie trolley for wheeling away or alternatively on to a casting conveyor for travelling to the cleaning department.



MR. R. SPRIGGS.

For large box moulds, which are too heavy for hand labour, high-speed hoists are used to part the mould and transfer it to a large jolting grid capable of taking the two halves of the mould side by side. At this point, besides the provision of good hoists, the most convenient form of slings, and an efficient jolting grid, special consideration must be given to space requirements for working and the easy disposal of the castings.

Bands Replacing Elevators

Another improvement, not quite so noticeable, but still very important, is the substitution, where possible, of inclined belt conveyors for the vertical elevators previously employed for elevating "used" sand. Although much has been done to improve the vertical elevator in the foundry, it still retains some of its inherent disadvantages, and when an inclined band can be substituted it gives much better results.

The inclined band conveyor requires less attention, spillage can be almost eliminated, and there is the added advantage that the steam in the knocked-out sand can get away easier. Some engineers have gone to the length of putting in continuous gravity bucket conveyors under the knockout to avoid spillage between the underground conveyor and the elevator. Figs. 3 and 4 illustrate this type of plant. An inspection of this job underground shows it to be remarkably clean when compared with any of the older installations.

Mould Conveying

In mould conveying and handling, recent developments tend towards completely mechanical jobs. Many firms after using roller conveyors for mould conveying over a number of years have discarded them and gone in for continuous power-driven mould conveyors. The idea of "rounding off a sand handling and machine moulding equipment with one or two simple and cheap gravity conveyors"* is one which will hardly bear investigation. In the first place gravity conveyors for foundry work should not be of the simple and cheap variety; such a class of conveyor will hardly do for orange boxes, and foundry conditions call insistently for something very much better. Moreover, a continuous mould conveyor working with efficient knockout arrangements will show a 50-per cent. labour saving over what can be obtained by gravity conveyors, simple and cheap or otherwise.

This is not to decry gravity conveyors, which have a definite and useful place in the foundry. This point will be dealt with later.

Sand-treatment and distribution plants are much improved, and, within limits, the system is

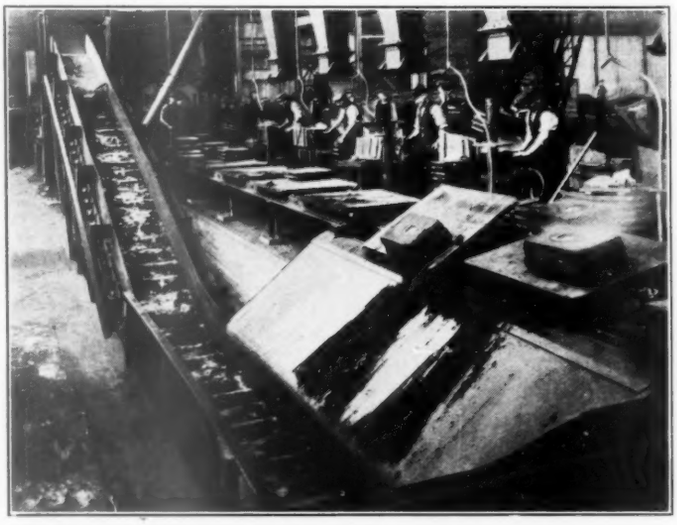


FIG. 1.—AN AUTOMATIC KNOCK-OUT, SHOWING COMMENCEMENT OF THE SYSTEM.

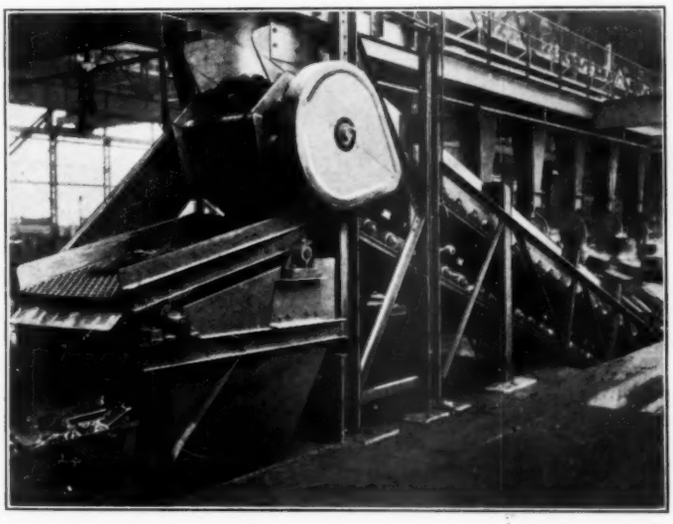


FIG. 2.—THE TERMINATION OF THE KNOCK-OUT SHOWN IN FIG. 1.

* FOUNDRY TRADE JOURNAL, August 9, 1934, page 89.

becoming more or less uniform. The treatment comprises metal extracting, screening, milling, aerating and distributing, each plant including a large storage bin for used sand, and storage bins with graduated automatic feeds for new sand and coal dust. Screening in some cases was not thought to be important, and it would not be, if one could obtain a 100 per cent. efficient magnetic separator for taking out tramp iron. Unfortunately, the best that can be expected is 98 per cent. efficiency, and without a screen to catch the odd piece, which will pass the magnetic separator sometimes, one may get a clamp or something of large dimensions through to play havoc with the Sand-slinger or mill.

FIG. 3.—A BUCKET ELEVATOR FOR SAND HANDLING, WHICH BY GRAVITY RUNS DOWNWARDS AND FEEDS THE UNDERGROUND SPILLAGE CONVEYOR SHOWN IN FIG. 4.

Two sand systems (facing and backing) are seldom used, the general tendency being towards a single or unit sand system which has the advantage of being less costly and provides a sand eminently satisfactory for average needs.

The improvements lie in more efficient magnetic-metal separators, screens specially designed to stand the conditions of foundry service, a greater variety and many improvements in sand mills and mixers. Fig. 5 shows a recent development in this direction which is exciting interest. This mill is continuous in operation, and the amount of rolling or rubbing of the sand can be readily varied to suit the requirements of the job. It is of special interest to those foundrymen who are developing synthetic sand.

Push Plates on Belts and Ploughs

In sand distribution the belt conveyor with adjustable ploughs is still competing with the push-plate conveyor. The disadvantage of the belt for this class of work is that with six or more feed points it is necessary to have a man on the top to adjust and regulate the feeds, whereas this is unnecessary with a push plate, the feeds of which are entirely automatic. The cost of maintenance was a disadvantage of the push-plate type of conveyor in a foundry, but here again the engineer has mastered his job, and by the use of totally-enclosed ball bearings to all runners and pedestals he can provide a conveyor which will last for years without requiring renewals. The first cost of the push-plate conveyor is, of course, greater, but it releases one labourer for more profitable employment.

The general increase in core work and the marked success of the continuous core-drying systems have created a new demand for conveyors both to feed in the green cores and to take away the finished product. The handling of green cores is a delicate matter calling for conveyors with special arrangements to reduce vibration to a minimum. This has been successfully accomplished by overhead chain conveyors with pendant tier carriers, fitted with special vibration and shock absorbers. This type of conveyor has many advantages. For example, if a carrier is not discharged, it merely makes another circuit of the track; there can be no jamming up through the operator being temporarily absent. Again, side branches or dead lines can be introduced so that loads of baked cores can be switched off the power line and left standing until required. The conveyor can thus be used as a store.

No attempt has been made in this article to deal with the many new moulding machines. Whilst there were moulding machines before mechanisation was thought of, it is certain that

FIG. 4.—SHOWS THE BOOT OF THE ELEVATOR IN FIG. 3 FEEDING THE UNDERGROUND SPILLAGE CONVEYOR.

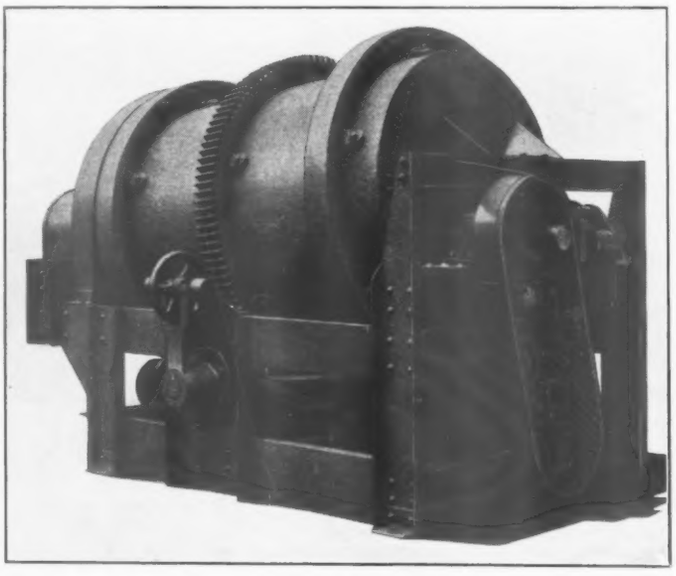


FIG. 5.—A RECENT DEVELOPMENT IN SAND MIXING SPECIALLY SUITABLE FOR SYNTHETIC SANDS.

the progress made in mechanisation has had its effect on the development of moulding machines generally, with the result that many new machines are appearing which indicate that the moulding-machine maker is fully alive to the possibilities of the present situation.

used for mould conveyors on batch work, for returning empty boxes for moulders and for taking castings away from the foundry. Its chief function in many foundries is, however, not in the moulding shop, but in the cleaning and fettling department and in the stores. Many

ing and inspection departments have turned out to be a very profitable investment. Such a system is shown in Figs. 8 and 9.

A final development is the creation of the foundry-conveyor expert whose life job is to scheme out, with the foundryman's help, con-

FIG. 6.—ROLLER RACK SYSTEM FOR CASTING STORES.

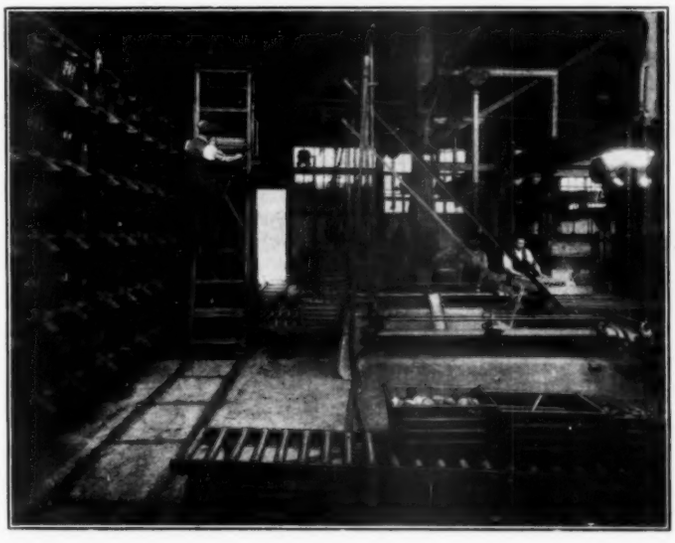


FIG. 7.—SHOWING HOW THE UPPER ROWS OF BINS ARE EASILY REACHED.

FIG. 8.—ROLLERS TRACK INSTALLED IN A FETTLING SHOP.

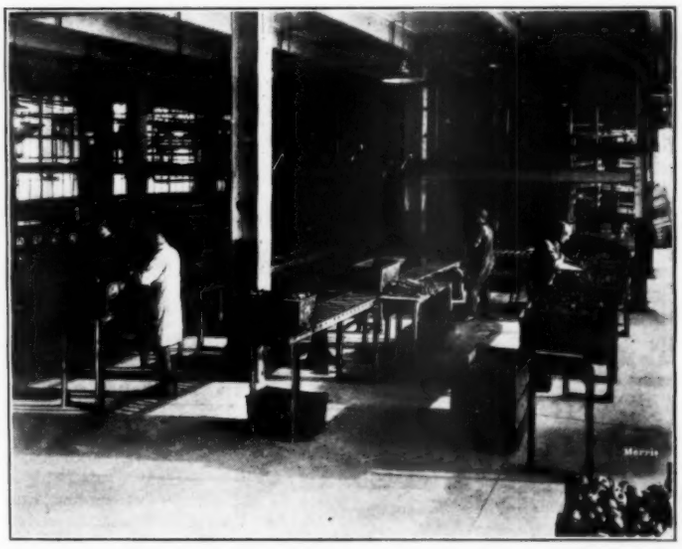


FIG. 9.—SHOWING HOW INSPECTION IS FACILITATED BY ROLLER TRACK CONVEYORS.

Gravity Conveyors

Returning now to the subject of the gravity conveyor, this has proved in many foundries to be the first regular step in mechanisation. The foundryman has bought a few lengths to try, and the more he tries with it the more possibilities he sees for conveyors. It is still largely

foundries have installed thousands of feet of this conveyor for handling containers of castings through the fettling shops, through the stores and so to machine shop or despatch department. The roller rack system for stores work (as is shown in Figs. 6 and 7) has proved a great advantage. Similarly roller tracks for the clean-

tinuous systems to suit the special requirements of each foundry. Each job he does augments his experience and increases his value to the foundry industry. He is usually an enthusiast, always hoping one day to produce the perfect lay-out.

Publication Received

Twentieth Century Vitreous Enamelling. Published by J. Gray & Sons, Limited, 5, Victoria Street, London, S.W.1.

This thirty-two page well-bound and splendidly-illustrated booklet, first of all describes the works of Messrs. J. F. Stewart & Company, Limited, and stresses the care bestowed upon

the selection of materials, the supervision during manufacture and the experimental facilities they possess. The second portion impresses one with the standing which the publishers have created for themselves within the industry, as their customers have accorded permission to reproduce pictures of their works. These include Sidney Flavel & Company. Vulcan Stove Company, Limited, Exeter, the Parkinson Stove Company, Sterling Manufacturing Company, Rustless Iron Company, Limited, and Belling & Company. The light-grey back has been well chosen, as it gives a dignified appearance to the booklet. Any firm which has not yet received a copy would be well advised to procure one, as it makes really interesting reading.

XUM

Recent Developments in Welding as Applied to the Foundry Industry

By R. TYLER, F.I.C., and L. C. PERCIVAL B.Sc.

WELDING can be divided into two distinct and separate categories—forge welding in which the parts to be joined are separately heated, brought together and then mechanically worked in a forge, and fusion welding in which the parts to be united are joined together by the melting of their adjacent surfaces.

Forge welding has no application in the foundry for production or amelioration of castings, but properly and intelligently applied fusion welding can be of the greatest service to the foundry and its proper application can do much to ensure greater and more economical output. In fact, fusion welding had its origin in the foundry. The desire to make good or salvage defective, broken, or damaged castings, led to the introduction of the process of "burning-on," a process well known to foundrymen and one which has stood them in good stead in the past. Its use was limited in practice due to cost of the metal required (and generally wasted in its application) of moulding, of dressing, and last, but not least, the element of uncertainty which attended its use.

It was natural that with the advent of the more modern and cheaper methods of fusion welding, such as the electric arc and oxy-acetylene, the "burning-on" method should fall more or less into disuse. It seems unfortunate at this date that the foundryman did not more readily accept these more modern methods and mould them to his requirements, for who had a better knowledge of metals in the state of fusion and in the cast condition than he?

Unfortunately, fusion welding seems to have been regarded as an encroachment upon his province, and out of prejudice, etc., it was left to welders who, in the early days had only limited knowledge of the manufacture and treatment of castings, to try to work independently in applying fusion welding to broken or defective castings.

This naturally directed the attention of the welder to materials which he could more easily handle and treat, for example, wrought materials; hence, to-day there are so many applications of welding to the fabrication of parts in mild steel, such as engine beds, base frames for machinery, etc., which were always regarded as essentially foundry work. Whether it is this trend of events or not that has led the founder to turn his attention more seriously to fusion welding it is not possible to say, yet undoubtedly much of the old prejudice seems either to have disappeared or is in the process of disappearance, and technicians are now anxious to see how the process can be, and is being, applied to their industry.

Unfortunately, there are well-known cases, for example, in the electrical-machine trades, where castings have almost entirely given place to weldings and entire foundries have been replaced by welding shops. With a better knowledge and understanding of welding by fusion methods on the part of the founder, and its application to the fabrication of components from castings, it is quite possible that he will be in a better competitive position to retrieve some of the work lost by the introduction of weldings.

Even in foundries which possess the most up-to-date equipment and which are organised on the most modern lines, castings poured from one ladle of metal into moulds made as nearly as possible alike by the same moulder, will show marked variations.

Some castings will be considered unsatisfactory on inspection, owing to the prevalence of surface defects, such as scabs, blow-holes and other flaws, but these can be, and are, economically and satisfactorily salvaged by the application of a fusion or so-called autogeneous welding process. Other castings may have to be definitely scrapped by reason of the extent and location of the defects. This last applies to small repetition castings where the cost of replacement is less than that of rectifying, rather than to large castings where the cost of welding is small compared with the cost of producing a new casting.

In the early days of fusion welding, now some 30 years ago, its adoption and the progress made, were slow, due in no small measure to inherent prejudice, suspicion and uncertainty in the minds of inspectors and buying authorities. As is ever the case, such a new process, which has now gone far to revolutionise production methods and reduce wastage to a minimum, has had to contest every step in its progress, until it reached the point of universal recognition which it now holds securely.

From the first crude and uncontrolled experiments in the repair of small and less important castings, and more especially castings which failed in service, development has resulted to such an extent that welding has now been adopted, not only as a means of salvaging faulty castings, but as an economic method of production of weldings as substitutes for castings which, up to a few years ago, were definitely regarded as the exclusive field of the foundry.

A very early experiment with which one of the authors was associated consisted of filling up a cavity in a solid iron casting. The experiment was carried out by connecting one pole to the casting and one to a carbon electrode. The hole was filled with grey-iron filings, of which there happened to be a plentiful supply available. The resulting weld was sufficiently satisfactory to encourage further experiments along similar lines.

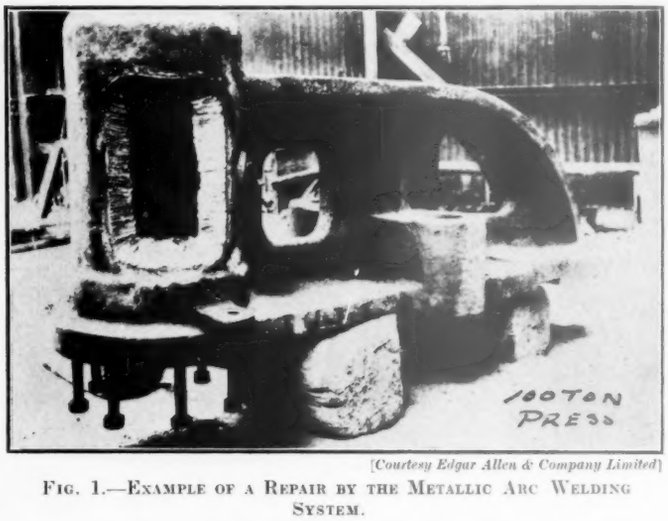
Following on these early experiments, the carbon-arc process of fusion welding was developed, and was largely used for repair work on defective castings in the foundry with which one of the joint authors was assocoated.

Other processes, including the Thermit process, have been used, but at the present time the metallic electric arc and the oxy-acetylene fusion welding processes are chiefly used, the latter having the widest field of application. The reason why the oxy-acetylene process has this distinction is its applicability to both ferrous and non-ferrous metal welding, and the fact that it is usually possible to deposit a weld metal of similar colour, composition and structure to the metal of which the casting is composed.

The Metallic Electric Arc process in which the filler rod either bare or coated is connected to one pole and the work to the other, is extensively used for reclaiming defective castings and for the production of weldings from rolled steel sections.

In the metallic electric arc process, fusion of the work and of the filler material take place simultaneously so that only a

(*Continued on page* 20.)



[*Courtesy Edgar Allen & Company Limited*]

FIG. 1.—EXAMPLE OF A REPAIR BY THE METALLIC ARC WELDING SYSTEM.

FIG. 2.—THE CASTING SHOWN IN FIG. 1 AFTER REPAIR.

Commercial Technical Development within the Refractories Industry during 1934

By FRANK SCOTT RUSSELL (Managing Director of General Refractories, Limited)

Better Refractories

THE year 1934 has been exceptionally fruitful in progress towards the production of better refractories. Little by little the research work of Mellor, Rees, Green, Lynam, Skerl—to mention only a few names out of a long list—establishes a greater and surer hold over the makers of refractories.

Scientifically-minded managers, often with technical training acquired at a University, are gradually supplanting the old-fashioned rule-of-thumb men who worked on lines established half a century ago, and never varied them except when circumstances made it seem easier to do something nearly the same but not quite.

With certain brilliant exceptions the old school was satisfied with a low standard of shape, accuracy of dimensions, and regularity of composition, firing and appearance, but the new man aims high and ever higher, seeks for perfection in every detail, and "hitches his wagon to a star."

The result has been, and is, an insistent demand for more and better plant, keener tools with which to work, and every help that science and engineering can give, and this has materialised in the installation of Dressler & Harrop Tunnel Kilns, a crop of tunnel driers to replace the old but handy drying floors, "stoves" or flats, new pan mills, crushers, mixers, etc., ball bearings to lessen friction, all arranged in an ideal flow to reduce handling costs.

Powerful Brick Presses

In some cases there have been installed the most powerful and efficient brick presses that ingenuity can conceive and money can buy, and one effect of all this re-equipment is such a perfection and regularity of British product that it can truly be said that no imported refractory brick, of no matter what type or composition, has one single point of superiority over the best of the British brands.

The refractory industry easily divides itself into sections: (1) Sand; (2) Plastics, (3) Bricks—in order of simplicity and ease of operation.

Sand Development

In the sand section, more and more attention has been paid during the year to the use of synthetic sands, *i.e.*, those in which the bond has been added mechanically, as against naturally-bonded sands, which owe their bond to Nature's (at times) somewhat haphazard distribution of her bounty.

The best moulding-sand mixtures for use in steel foundries (in particular) are now made from "graded" sands, with added bond in quantity carefully calculated to suit the purpose for which the sand is to be used, and with moisture content scientifically controlled.

Thus is attained dependability, control and certainty of result. There is undoubtedly a field for such synthetic sands in the ironfoundries of this country, and one supplier, at least, is doing a rapidly-increasing trade in this direction.

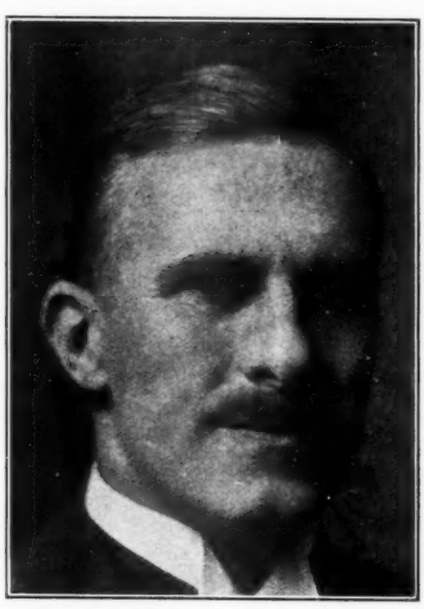
Plastic Refractories

In the Plastic Department our old, old friend "ground ganister" ("age cannot wither her nor custom stale her infinite variety"), is still an omnibus term covering a multitude of sins, and sandstones, cherts and firestones, milled up with fireclays of all manner of types and degrees of inferiority.

There has, however, been established the "Standard Sheffield ganister," made to a formula settled by the Refractories Department of Sheffield University (to which and to whose genial and able Principal, Mr. W. J. Rees, M.Sc., F.I.C., the industry owes so much inspiration and enlightenment), and which is, or should be, an utterly reliable product, consisting only of that black Sheffield ganister rock, which was the nucleus of the refractory eminence of Sheffield, mixed with a fireclay at one and the same time highly refractory and very plastic and sticky.

The bed of ganister rock referred to, lies below the "Halifax Hard Bed" of coal, and is well developed at Deepcar; near Penistone; in Sheffield itself, and at or near Stannington and Oughtybridge.

The particular fireclay needed to give the best results is, however, rare, and possessed by but



MR. FRANK SCOTT RUSSELL.

few of the ganister-making companies, and it may here be mentioned that so high is the present-day cost of both best ganister rock and the special type of fireclay required, that it is impossible for any maker to sell the true and genuine "Standard Sheffield ganister" at a low price.

Increased Cupola Efficiency

One high authority has, however, recently said that the increase in cupola efficiency which has been attained of late years has called for a better lining and patching material, and experience has shown that the higher first cost of such better material, as for instance "Standard Sheffield ganister," is more than offset by the smaller quantity used, and in the savings effected by the reduced charge for labour for the fettling and patching of the cupola.

The use of rammed linings for cupolas does not, during the past year, appear to have made unusual headway, but the system still has its advocates and propagandists.

Monolithic Refractories

Amongst other recent noteworthy developments in plastics there is the rapidly-extending use of Monolithic refractories for such applications as boiler furnaces in which the elimination of intricate firebrick shapes is made possible by the use of refractory concretes such as "Durax," which are cast into position in the same way as ordinary building concrete.

Rotary Furnace Linings

A further development of a similar character is in the direction of the production of an efficient all-British lining for furnaces of the rotary type such as the Sesci, the Brackelsberg, and the oil-fired furnace of Messrs. Stein & Atkinson. These types of furnace originated and were perfected abroad, and for a long time their linings had to be imported.

Latterly, however, two or three British makers have, after painstaking experiments, succeeded in producing lining materials which have given excellent results, and it is expected that further research in 1935 will render users of rotary furnaces in this country quite independent of foreign supplies of refractory materials.

Improvements in Special Fire Bricks

During the year the greatest advances, perhaps, have been made in the continued steady improvements in magnesite, diazite, chrome, chrome-magnesite and sillimanite bricks, the last named gaining vastly in popularity amongst glassmakers during the year.

All these types of brick have been improved during the year by certain makers by the adoption of the system of "grading" the raw material—that is to say, of making the brick out of a material previously ground and screened to certain sizes, and from which is taken, with the strictest regularity, a certain quantity of size No. 1 and of sizes Nos. 2, 3 and 4, such sizes and quantities being settled after long-continued and patient research, trial and experiment.

The result is that the grains fit closely together to produce a solid compact brick as low in porosity, and as free from voids as is possible, and, in consequence, much more resistant to both heat and to the attack of slags.

In contrast with the old system of throwing lumps of the raw material into a revolving pan mill and leaving it there until the man in charge thought it "felt" about "right," the new system is very costly to install, and not very cheap to operate, but it is unquestionably a positive forward step up the rapidly-steepening heights of progress.

Forsterite—a New Refractory

A great deal of original work has been done during the year in connection with Forsterite ($2MgO\ SiO_2$) as a new refractory material, and the New Year is expected to show marked advances in this direction, as this material has been proved to have unique qualities—all its own.

Fused Refractories

It has long been known that pre-fused refractories had remarkable qualities, but little in the way of large-scale experimental work could be done with them, because of the difficulty of obtaining supplies of fused materials at a reasonable cost, or at all.

This difficulty has recently been overcome by my own company, who have arranged for the electrical fusion of their own magnesite, chromite, bauxite and sillimanite, both alone and together in the form of spinels. Research work in connection with these pre-fused materials is now proceeding, and revolutionary results would

not surprise those who have previously experimented with such ingredients.

It is anticipated that in a few weeks bricks made from them will, for the first time in the history of the refractories industry, be available for practical service tests under working conditions.

This much may be said already, that from prefused pure magnesite and a chrome-alumina spinel can be produced a brick which appears to be outstandingly superior to either magnesite or chrome, and that energetic steps are being taken to perfect it.

Unfired Magnesites

The year has seen some advance in the direction of the use of an unfired brick made under intense pressure, but without burning. It does not spall like a brick which has been fired, and is useful in many special cases.

Heat Insulation

The practice of insulating against heat losses grows apace, and with highly satisfactory results to users. Neither furnace nor kiln is now erected by an enlightened engineer unless it incorporates some measure of heat insulation, and specially great strides have been made in the direction of avoiding heat losses from open-hearth furnaces.

Most new brick kilns are completely insulated with diatomite bricks from sole to crown with resultant savings of up to 20 per cent. in the weight of fuel consumed, and it is of great interest to be able to report that following the discovery in Portugal of an inexhaustible deposit of diatomite of the highest known quality, equalled only by the best and most expensive of the Californian diatomaceous earths and of such refractoriness that it shows no signs of fusion at over 1,500 deg. C., energetic steps are being taken to produce insulating bricks at once strong and refractory, and above all, non-conducting to a degree seldom hitherto equalled.

The deposit referred to is now under the control of a British company and is held by all who have inspected it to be unique.

Silica Bricks

British silica bricks have for many years been valued for their refractory qualities, and recent developments in this department have been in the direction of better shapes and surface finish, which have improved an already excellent product.

The new specification of the Institute of Gas Engineers refers more particularly to silica bricks for coke ovens and is very valuable to makers of bricks for this purpose because it gives them an accessible standard to work to and one which, if fulfilled, guards the maker against subsequent complaints due to mishandling by the user.

The high quality of British coke-oven and gas-retort shapes has long been a legitimate source of pride to the British refractories industry, and has justified the heavy exports in this line, and the very small proportion of imports into Great Britain.

Mis-statements on this subject have recently appeared in the Press, and attempts have been made to mislead the public to suppose that the bulk of the high-grade silica bricks used in the country were imported, but energetic steps were taken by the industry's leaders and its trade and technical institutions to refute so dangerous a libel on the industry.

To sum up, the year 1934 has shown many definite and valuable improvements in the quality of British refractories. The urge from the user for better and still better refractories is intensifying, and the maker is doing his utmost, both by the use of research, greater care and better processes, to satisfy the consumer and supply him with refractories that will help him to do his own difficult work with greater ease, less expense and increased certainty of good results.

Recent Developments in Welding as Applied to the Foundry Industry

(*Continued from page* 18.)

small portion of the weld seam is played upon, whereas, in the fusion gas welding process, the filler rod is added to the molten edges of the work, thus in the former case the welding metal cools more rapidly than in the latter case. It is therefore easier to obtain proper fusion of the parent metal and filler metal in the fusion gas welding process.

In the metallic electric arc process gases are

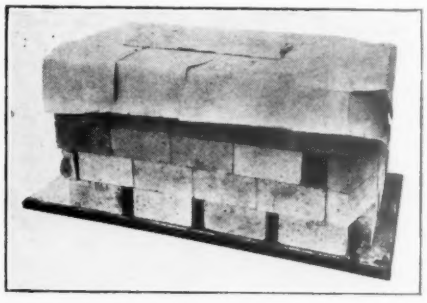


FIG. 3.—TEMPORARY FURNACE FOR PREHEATING PRIOR TO WELDING.

readily absorbed but this may be counteracted to a large extent by the use of coated electrodes.

It is claimed that stresses and distortions occur much more often with fusion gas welding than with metallic electric arc welding, but it is conceded that fusion gas welding should be adopted in those cases where high ductility of the weld seam is required and where bending stresses occur.

Where the welding causes stresses and distortions which render the work difficult to accomplish, metallic electric arc welding would be more suitable. An example of a repair by this process is shown in Figs. 1 and 2.

The practice of "burning-on" is still resorted to as a means of salvage. This process, however, is definitely more expensive and wasteful in materials, labour and foundry space than the fusion welding processes.

This will be readily understood when a comparison is made between the cost on the one hand of tinplates, moulds, molten metal and the time occupied in producing them, and on the other hand the cost of gases and welding rods and the time occupied in setting up and welding.

The "burning-on" process has in consequence, given place to fusion welding processes in up-to-date and modernised foundries. It will be obvious that "burning-on" has strict limitations in that it has only one form of application. If this process is compared with fusion welding, it is found that there is a choice of methods whereby the heating of the parent casting may be utilised or avoided according to the form and the nature of the repair. In the fusion method the filler rod consists of material definitely designed to give the weld metal similar to that of the casting itself. As the term "fusion" denotes, both the filler rod and edges of the casting itself adjacent to this joint are brought to a molten condition by this method and intense and very local, but not mass-heating of the joining surfaces of the casting ensues. Either local preheating with a gas, oil or oxy-acetylene blowpipe flame, or mass preheating by means of a charcoal or similarly designed furnace, is usually applied to the casting prior to welding.

The most convenient and most generally used type of preheating furnace is constructed with loose fire-bricks and arranged to enclose a part or the whole of the casting as occasion demands, the furnace may be covered with a sheet of asbestos and the heat supplied by a charcoal fire in a brazier, or arranged round the casting in the temporary furnace, as shown in Figs. 3 and 4. Where a large quantity of preheating is done, a permanent gas or oil-fired furnace, preferably of the muffle type, is used.

Bronze Welding

By utilising these precautionary measures, restrained or concentrated stresses are avoided both during the welding and subsequent cooling operations. Sometimes it is unnecessary, as in the case of welding lugs or feet on castings such as machine tools, electric-motor casings, and the like, to preheat castings; in such cases the so-called bronze-welding process is often used. This process can be applied to the welding of castings without preheating to any great extent, and differs from the fusion-welding process referred to above, in that the parent metal is not actually melted, but raised to a temperature which is just sufficient to permit surface alloying, the preheating itself never resulting in a temperature of more than 400 deg. C. There exists after welding a marked difference in colour between the weld metal and the parent metal, but in the majority of cases this is not detrimental.

In all ordinary circumstances, galvanic action due to dissimilarity between weld metal and parent metal is not apparent. Incidentally, the strength of a bronze weld is generally comparable with that of the ordinary grey-iron casting, this statement being based on the comparison

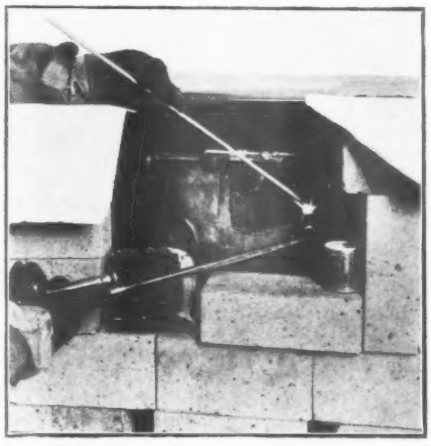


FIG. 4.—SHOWING TEMPORARY FURNACE IN USE.

between the strength of the cast iron and the actual bond, it being understood that the bronze-weld metal has a greater strength than ordinary grey cast irons.

With regard to the welding of malleable-iron castings, bronze welding is the accepted method; in fact, the only satisfactory method. Briefly, the reason for this is that the temperature necessary for bronze welding does not result in the destruction of the malleability of the iron due to recombination of the carbon.

(*To be concluded.*)

The Light Alloy Castings Industry in 1934

By W. C. DEVEREUX (Managing Director of High Duty Alloys, Slough)

THE past year has seen numerous new applications of aluminium and its alloys. Probably in no previous year have the light alloys received so much attention from the designers of machinery generally, it being realised that considerable saving can be made by the proper applications of the light-weight alloys for many purposes. This is no doubt due to the fact that the technical application of these alloys has been made better known, and that the manufacturers of these alloys have made a more careful study of the applications, having at last taken the wise step of making their limitations known. The consequence is there is now considerably more satisfaction in the use of the materials than previously.

Aluminium alloys still hold the supreme position in aircraft. New applications have been introduced in the use of special aluminium alloys for valve guides; sealing rings for water-cooled engines in place of copper, and copper-asbestos washers. One interesting casting used is shown in Fig. 1, that of a crankcase for a Diesel engine, designed principally for use in large aircraft. This casting weighs 4 cwts. 0 qr. 2 lbs., and was made by the Birmingham Aluminium Company, in "Hiduminium" R.R.50 alloy.

Both aluminium and magnesium alloys are being used in increasing quantities in the automobile and commercial-vehicle industry. A new application has been brought about by the extensive use of Diesel engines, where many thousands of cylinder heads are now in service, but the principal advance has been in the use of unbushed aluminium-alloy connecting rods running direct on to case-hardened shafts.

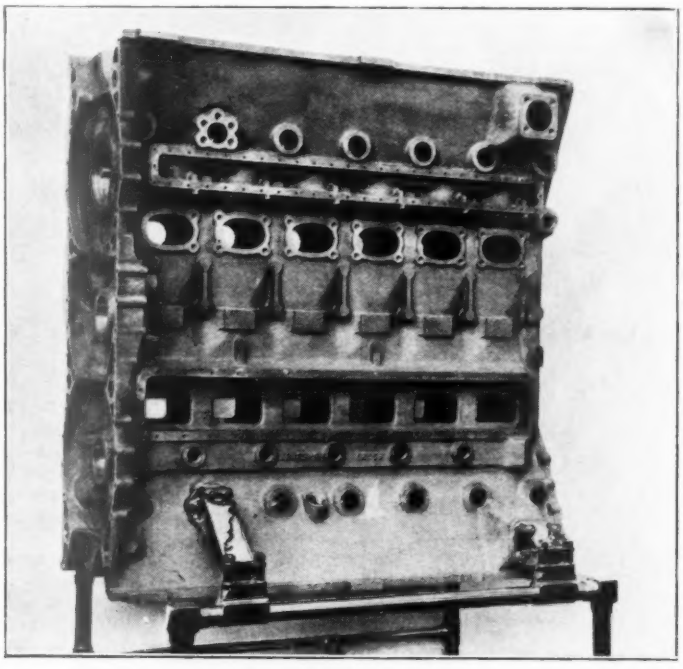


FIG. 1.—JUNKERS CULVERIN CRANKCASE (MESSRS. D. NAPIER & SONS, LIMITED), CAST BY THE BIRMINGHAM ALUMINIUM COMPANY, IN "HIDUMINIUM" R.R. 50 MATERIAL.

Use in Railway Engineering

The large quantity of bearings that are giving successful service in forged aluminium alloys is not generally known. The locomotive industry is absorbing large quantities of aluminium castings and forgings, while the railway-carriage makers are using aluminium alloys extensively for such parts as railway-carriage doors, fittings, seat pillars, etc. The outstanding application in the locomotive field, however, is that of pistons, and Fig. 2 shows pistons manufactured in "Hiduminium" R.R.59 alloy.

The textile industry during this year has utilised aluminium alloys to a considerable extent for the fast-moving parts of machines, and in the wrapping and cutting industry. Considerable speeding-up has been attained in all types of machines utilising aluminium alloys, which for fast-moving parts have largely taken the place of steel, gun-metal, malleable iron, and cast-iron levers. Many thousands of bobbins for the textile industry are now made in aluminium alloys.

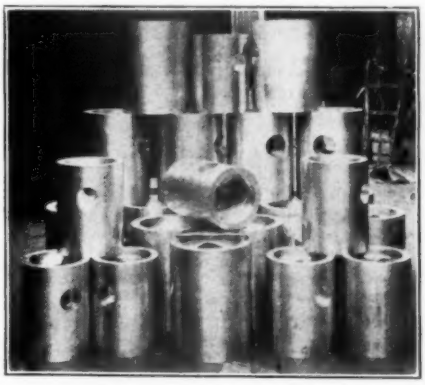


FIG. 2.—DIESEL PISTON FORGINGS, 12 IN. DIA., IN "HIDUMINIUM" R.R. 59 ALLOY, MADE BY HIGH DUTY ALLOYS, LIMITED, SLOUGH.

Tanks and Salt Mines

Tanks for mechanical warfare have a considerable portion of undercarriage castings made in the light alloys, and, of course, the propelling engines are largely made up of these materials. In salt works and salt mines one would hardly suspect the use of aluminium alloys, but many tons of material are being used successfully in the form of conveyor buckets, conveyor chains, conveyor worms, etc. One important reason for the use of these materials is the fact that they do not stain the salt, as is the case with steel, and do not splinter as is possible with the wooden buckets previously used. The materials also are entirely absent from toxic action. In architecture there has been renewed and keen interest by leading architects, aluminium castings and extruded sections being utilised in many of the new buildings in London for decorative purposes. These parts, subjected to anodic treatment, may be dyed any colour, and full advantage has been taken of this wonderful new outlet.

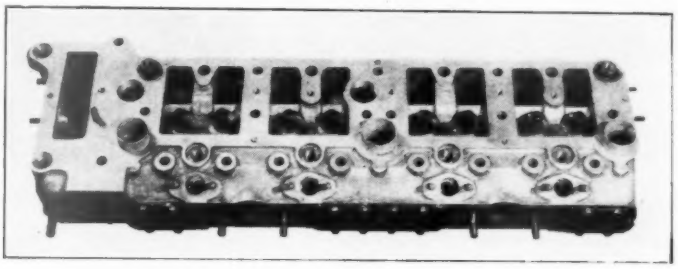


FIG. 3.—DIESEL-ENGINE CYLINDER HEAD CAST IN "HIDUMINIUM" R.R. 53 ALLOY BY HIGH DUTY ALLOYS, LIMITED, SLOUGH.

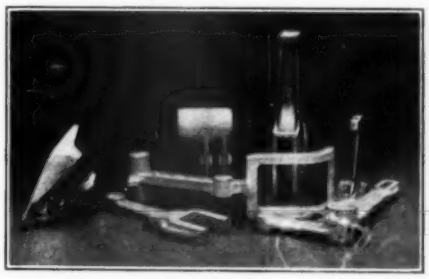


FIG. 4.—TEXTILE LEVER CASTINGS MADE IN "HIDUMINIUM" R.R. 53B MATERIAL.

The Photographic Industry

In no previous year has one seen such use made in the cycle industry of aluminium-alloy tubes, forgings and castings. The general tech-

nique of the aluminium-alloy industry has also interests for photography. In this connection the most interesting application of recent times is in the use of aluminium foil in the photographic industry. Successful experimental results have been obtained using oxidised aluminium foil as a base for light-sensitive chemicals. The immediate future holds prospects of extensive demands for aluminium in this field. The absolute elimination of fire risks from films demands keen attention to this particular application.

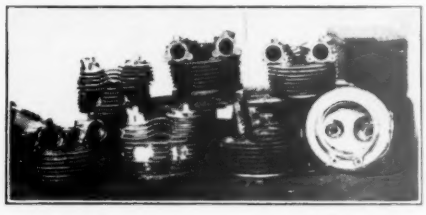


FIG. 5.—AIRCRAFT-ENGINE AIR-COOLED CYLINDER HEADS CAST IN "HIDUMINIUM" R.R. 53 ALLOY.

In distillation plant arc-welded condensers have been used, whilst aluminium foil has been used for insulation purposes in refrigeration and in furnaces. The transport of milk and beer is largely carried on with vehicles utilising aluminium tanks, the tanks being supported by aluminium-alloy castings. Unquestionably, there was a considerable increase in business in 1934, and it seems that 1935 augurs very well for the light-alloy industry.

Magnesium Alloys

As regards the magnesium alloys, whilst last year brought forth very few new applications, there was a very considerable growth of business in the automobile industry in the form of crankcases, gearbox covers, etc. Whether manufacturing "Elektron" or "Magnuminium," the works have throughout the year been exceedingly busy, and are likely to continue so. One important application for the use of magnesium tubing has been in the insulation of household electrical utensils.

A review of the past year gives anyone engaged in the light-alloy industry considerable hope for the future, and it is to be hoped that the definite increase in the quality of castings will continue. The necessity for quality is becoming more and more apparent, and there is not the same room for the small inefficiently-run foundry whose only hope of business in the past has been to quote absurdly-low prices, to the detriment of the industry as a whole, and those firms that throughout the trade depression have had the courage to maintain their quality and prices are now in a very strong position.

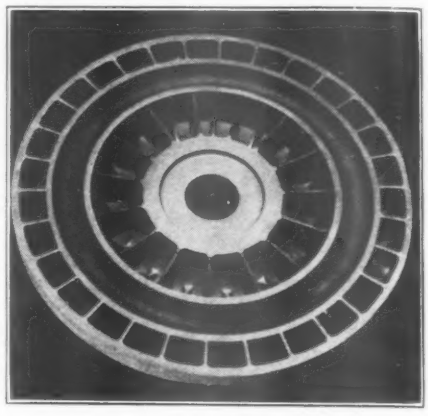


FIG. 6.—FLUID FLYWHEEL CASTING IN "HIDUMINIUM" R.R. 50 ALLOY.

The Isolated Foundry: Its Advantages and Drawbacks

By C. P. NEWMAN (Chairman of Newman, Hender & Company, Limited)

THE author's foundry being situated at Woodchester, in Gloucestershire, can be regarded as a foundry which is essentially like many in this country which were conceived by their founders and have been carried on for many years in "splendid isolation." Those readers who possess foundries in Glasgow, Manchester or Birmingham have those perhaps somewhat intangible, but nevertheless appreciable, benefits derived from meeting with their competitors in the clubs, trains and hotels, whilst their managers and foremen are constantly rubbing shoulders at meetings of technical associations. The competency of the moulder, too, can often be judged from the nature of the shop in which he last worked. The material help accorded by the local gas and water companies, electricity and other municipal departments when he is installing new plant must be of real assistance to the foundry owner in the thickly-populated areas. The facilities for evening study by the technical and operative staff are advantages which are much more inconveniently available to the isolated foundry owner. Paradoxically it would seem that all these advantages possessed by the urban foundry owner have tended to make him more conservative than his rural competitor. For instance, in the list of mechanised foundries given by Mr. R. H. Brackenbury in his review of the foundry equipment industry in 1933, the major portion of these fall within the category of the "isolated" plants. Usually the country establishment has the advantage of lower local rates, but it generally has to pay more for a public supply of electricity and gas, which, furthermore, may be non-existent, and it therefore has to generate its own power, etc., and thus lock up considerable capital in this direction. Moreover, the delivered prices of raw materials are sometimes in excess of those accorded to the large industrial centres.

Care in Buying

During the past decade many an isolated foundry has had to modernise and specialise as the country jobbing foundry could no longer meet the competition emanating from the quantity-production foundries, for the local supply of gulley grates, manhole covers, lamp standards and the like. Buying has to be more carefully undertaken. In the large centres it is no uncommon thing for inadequate stock control to be unnoticed by the directorate as any shortage in supplies is masked by borrowing from a nearby establishment.

MR. C. P. NEWMAN.

Absence of Local Bias

Because of the large number of commercial representatives calling upon the foundries situated in congested areas, the problem of according adequate time for interviewing each one becomes onerous. Distance from the large centres undoubtedly effects a certain amount of dilution and the majority of representatives arriving can be treated as being reliable and keen individuals worthy of an interview. The main factor appears to the writer to be that freedom from any local bias makes for the incidence of true individual judgment and the accumulation of better plant in one's works.

In the foundries of Newman, Hender & Company, Limited, are to be seen machines and mechanised plant, which are indicative of a desire to create rather than merely emulate other people's efforts and discoveries. For example, finding nothing on the market which would seriously reduce the cost of expensive metal core-box upkeep, the life of which is naturally shortened through continually rapping, a core-box vice was designed which not only produces cores of superior dimensional accuracy, but is responsible for very appreciable economies in the core department.

Another feature is the use of hoppers above the moulding machines which are filled by sand-reconditioning and throwing machines. Whether or not this was the first installation of this kind in Great Britain, at least it was not a copy taken from the "foundry next door." The use of specially-designed conveyors for cores, moulds, return of empty moulding boxes, material to the melting station and castings through the dressing and cleaning shops is another modern method of economising labour costs. In the matter of core stoves and core-shop equipment generally, the writer has reason to believe that his plant is unique in Britain.

It certainly does seem that isolation and pioneering are synonymous. Foundries situated in the large centres would be well advised to exhibit more individualistic and original thought in their works' problems and not to imagine that because their next door neighbour has bought a certain plant or process that he must be slavishly copied. There are districts where to visit one foundry is to obtain a fairly representative picture of the majority of the local plants. This remark needs the qualification that there is usually one which stands alone in splendid (technical) isolation which acts as a model for the others to copy.

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Czecho-Slovakian Foundry Industry in 1934

By Professor Dr. MONT. Fr. PISEK (President of the Czecho-Slovakian Foundrymen's Association)

THE beginning of the year 1934 saw the Czecho-Slovakian foundry industry reach the zenith of the crisis. The dearth in the export of castings and machinery is being felt. The home market is very weak on account of the lack of money in circulation and the impossibility of getting credits. Foundries and engineering works are concentrating their energies on the home market. The prices are still depressed, even below cost; it is a struggle of all against all. But the well-established fact is again proving itself to be true, and that is the intense reduction of sale prices does not increase production. The stagnation is continuing, and the factories are growing weaker. The serious unemployment which is still felt in the engineering industry and which in the course of the year has somewhat diminished, obviously influences the foundries. The poor financial position of the municipalities—for the most part a result of inefficient communal policy during recent years—has curtailed the ordering of cast-iron water pipes, and, except in some rare cases, no new constructions of water mains are now being made.

House building has greatly decreased this year, which is very bad for the sale of fall pipes, baths and sanitary ware, whilst the Czecho-Slovakian State Railways have greatly limited their indents and are this year establishing their own foundry for the manufacture of brake shoes at Liberec.

As a consequence of the law concerning motor transport, which was intended to eliminate competition with the railways, the production of motor lorries has sensibly diminished. So far as passenger cars are concerned, only the small popular type is in demand. Instead of establishing a general foundry for the quantity production of motor cylinders replete with every modern equipment, each automobile factory had during better times established its own foundry for motor cylinders. As their production of cylinders was already too great to be economical and for a quantity production too small, a normal production on moulding machines has introduced semi-automatic methods, which to-day, with slackness of trade, increases the cost of production.

In the course of the year export of machinery has been somewhat better, and thus the foundries producing engineering castings had more work. These foundries have been this year 10 to 50 per cent. busier than in 1933, and thanks to the price-maintenance agreement of the two principal engine builders, Ceskomoravská-Kolben-Danek and Skoda a.s., for the home market better conditions have been experienced. It was chiefly the fierce competition between these two concerns which had such an adverse influence on selling prices in this country.

The situation of foundries for commercial castings did not change in comparison with the year 1933 and remains still unsatisfactory, with the exception of those foundries producing special and complicated castings which were distinctly busier, particularly towards the end of the year on account of Austrian orders. During this year some larger grey-iron foundries have ceased their production, and the end of the crisis seems not yet in sight.

Raw Materials

The prices for raw material for foundries, coke and pig-iron, have not changed since 1933 on account of the cartel prices; the price of coke was Kc. 35* for 100 kilograms delivered Brno, the price of No. 1 pig-iron Kc. 60 and "Vitkovice" hematite (0.15 per cent. P) Kc. 69. On the other hand, the market prices for machinery scrap have considerably increased as against 1933, due to the fact that exportation of this material from Germany is prohibited. A considerable increase in price has been observed in steel scrap, which was sold at the beginning of 1934 for Kc. 20, and reached towards the end of the year Kc. 35 to 45 per 100 kgs. This increase has been brought about by the creation of an ironworks and steelworks outside the cartel, and the fierce competition which arose between this enterprise and the cartel.

PROF. DR. MONT. FR. PISEK.

The selling price of castings is in some branches lower than its cost price. This is particularly the case with radiators, the selling prices of which are so low that some foundries have stopped producing them for a certain period. The reasons for the fall in prices are over-production and slackness in the building trades. Over-production is due to the fact that during the period of prosperity many foundries were specialising in this line. In Czecho-Slovakia there are altogether nine large foundries producing cast-iron radiators.

The situation is also poor for the sale of the various cast-iron stoves, as there is little building going on, whilst the mild winters of recent years have also had an unfavourable influence, and to-day many foundries have been unable to find work for their employees.

The results of the crisis have proved to be quite the opposite from what was expected. Instead of a concentration of production in the period of crisis in order to have a cheaper production, the foundries extended their production programme to include castings which did not enter into their line of business, and of which they would not have envisaged during normal times. The consequence of this was, of course, a depression of prices in the whole industry.

Better sale prices are now being obtained for high-grade castings, such as cylinder blocks. These castings are being sold, according to their complication, from Kc. 8 to 10 for 1 kg., export prices being somewhat lower. The market for cast-iron pipes, which latter were formerly exported in great quantities, is now definitely poor, and to-day practically no export business exists. Pipe foundries are carrying considerable stocks; they are members of the cartel.

The export to Austria has greatly diminished, which fact is particularly felt by the foundries in the district of Horovice and Brno. Austria buys to-day only such castings as are not produced there.

The situation amongst the steel foundries is also unsatisfactory. There are about ten steel foundries in Czecho-Slovakia. A normal diminution of trade on account of the crisis shows competition due to welding (unfortunately quite often parts of machines are welded, which would be cheaper made as castings), and the competition from special alloy castings has brought this branch of industry, which was once the most lucrative of all, into the worst possible condition. The steel-castings cartel has ceased to exist for several years, and there is no indication of its re-establishment; there is an internecine warfare under the conditions of constantly-increasing scrap prices on the one hand and decreasing selling prices on the other.

Even rather complicated castings may be had at the price of Kc. 5 per kilo, and there have been cases where a complicated steel cylinder was offered at Kc. 3.50 a kilo.

Malleable Non-Ferrous Foundries

The state of trade amongst the malleable foundries was quite satisfactory; their production has increased again during the year by 10 per cent. Prices, however, were decreased, and range between Kc. 3 to Kc. 10, the average price being Kc. 4.50 a kilo. There is not much to be said about the non-ferrous foundries. They were employed as during last year, but the fall of prices continued. The principal reason for this was the competition of many small brass foundries, where the owner works with a few apprentices at a very low cost and small profit.

The light-alloy foundries have suffered greatly from the reduction in the production of motor-cars—in some cases as much as 40 per cent. of last year's production.

Because of the crisis, only the ironworks at Vitkovice and Trinec have produced pig-iron. They chiefly worked for stock, for these particular blast furnaces must operate on account of the gases, which, through the high development of heat-economy systems, are used for the driving of all sorts of machines and for the heating of most of the auxiliary furnaces.

Plant investments in the foundry industry, distinctly heavy in the time of prosperity, were of a low order this past year. At present many of these investments are fairly ineffective, such as, for instance, the great complicated automatic sand-preparing plants, which are quite useless for handling the excellent quality of Czecho-Slovakian sands. These influence adversely selling prices with the small current production. The only plant investments now being made are those concerning direct economy, that is, the reconstruction of cupolas, drying stoves, and the like. There have been no new foundries erected; on the contrary, due to the low rate of production of castings in 1934, two big cast-iron foundries have been closed.

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* Rates of Exchange: Current. Kc. 118 to £: par, Kc. 164.25 to £.

The Foundry Industry Month by Month

January

SIR WILLIAM FIRTH is elected chairman of the Management Committee of the London Iron and Steel Exchange.

LORD HERBERT SCOTT nominated to succeed Sir George Macdonogh as President of the Federation of British Industries.

February

INSTITUTE OF BRITISH FOUNDRYMEN elects 32 new members.

MAJOR H. W. O'BRIEN is elected chairman of the Royal Metal Trades Pension and Benevolent Society.

BRITISH INDUSTRIES FAIR is held.

MR. HAROLD MACMILLAN, M.P., accepts office of President of the Institute of Industrial Administration.

THE NATIONAL FEDERATION OF IRON AND STEEL MANUFACTURERS appoints a committee, consisting of Sir Frederick Mills, Bt., M.P., Mr. C. U. Peat, M.P., and Sir William Larke, K.B.E., to prepare a final draft constitution.

VITREOUS ENAMELLERS meet in Birmingham to consider the advisability of forming a trade organisation. A Founding Committee is appointed.

March

DR. HAROLD MOORE, C.B.E., becomes President of the Institute of Metals.

MR. ANDREW L. MORTIMER is awarded the Surtees Gold Medal and first prize at the biennial examination at Glasgow.

MR. R. H. BRACKENBURY is re-elected President of the Foundry Trades' Equipment and Supplies Association.

MR. CHARLES D. RIGG, of Messrs. Smith & McLean, Limited, Glasgow, is appointed President of the Iron, Steel and Ironmongery Benevolent Association of Scotland.

DR. J. W. FRENCH, managing director of Messrs. Barr & Stroud, Limited, is elected President of the Royal Philosophical Society of Glasgow.

April

THE INSTITUTE OF VITREOUS ENAMELLERS is formed, and officers are elected for the year. Dr. J. W. Mellor, F.R.S., becomes the Foundation President.

SIR HARRY MCGOWAN has the honorary degree of Doctor of Laws conferred upon him by the Senate of the University of Glasgow.

ALDERMAN HENRY TOY, a Cornish foundry owner, receives a unanimous vote of thanks from the Helston Town Council for more than half-a-century of public work.

PROF. L. F. C. GIRARDET is elected President of the *Association Technique de Fonderie*.

THE INSTITUTE OF BRITISH FOUNDRYMEN elects 49 new members.

May

MR. JOHN T. BATEY, managing director of Messrs. R. & W. Hawthorn, Leslie & Company, Limited, Hebburn-on-Tyne, is elected President of the North-East Coast Institution of Engineers and Shipbuilders.

MR. SAM MAVOR, of Messrs. Mavor & Coulson, Limited, is appointed a member of the Standing Committee of the Council for Art and Industry in Scotland.

MR. EUGÈNE SCHNEIDER, chairman of the Société du Creusot, is elected to the Académie des Sciences Morales et Politiques.

MR. CLYDE E. WILLIAMS is appointed director and Dr. H. W. Gillett chief technical adviser, of the Battelle Memorial Institute, Columbus, Ohio, U.S.A.

MR. HAROLD E. COOKSON, managing director of C. Akrill & Company, Limited, is re-elected President of the Staffordshire Iron and Steel Institute.

MR. J. PERCY PLANT is elected chairman of the Board of Management of the Birmingham Section of the 1935 British Industries Fair.

June

SIR HUGO HIRST, BT., chairman and managing director of the General Electric Company, Limited, is created a Baron in the King's Birthday Honours List. Commander C. W. Craven, O.B.E., R.N. (rtd.), and Mr. Ronald W. Matthews are knighted.

MR. FRANK WAIN, of the Britannia Tube Company, Limited, is elected to the Board of Management of the Birmingham Section of the 1935 British Industries Fair.

THE INSTITUTE OF BRITISH FOUNDRYMEN holds its thirty-first annual conference at Manchester under the presidency of Mr. Roy Stubbs. MR. J. E. HURST and MR. H. WINTERTON are elected Vice-Presidents. MR. V. C. FAULKNER is awarded the Oliver Stubbs Medal.

OVERSEAS GUESTS included Dr. Ing. Heinrich Nipper (Germany) and Mr. Williams (India). Seven Papers are read and discussed.

THE SHEFFIELD FOUNDRY DEGREE COURSE is officially announced.

CAPTAIN J. I. CHESSHIRE, managing director of Messrs. Izons & Company, Limited, of West Bromwich, is appointed Deputy-Lieutenant for Staffordshire.

July

MR. W. H BASSETT succeeds Professor T. R. Lawson as President of the American Society for Testing Materials. His tenure of this office was cut short by his death a month later.

THE MERSEY TUNNEL, connecting Liverpool with Birkenhead, is officially opened by H.M. the King.

MR. J. WATSON SLACK makes a broadcast appeal on behalf of the Royal Metal Trades' Pension and Benevolent Society.

August

MR. CECIL CLAYTON is elected chairman of the Auxiliary Committee of the Royal Metal Trades Pension and Benevolent Society.

MR. JOHN CRAIG, C.B.E., chairman and managing director of Colvilles, Limited, is appointed Deputy Lieutenant of the County of Lanark.

MR. L. LEE, who is a member of the B.C.I.R.A. staff assisting Dr. Skerl at Sheffield, is awarded the Mappin Medal and a premium for being the best evening student in metallurgy who has passed the Associateship Examination of the University of Sheffield.

THE B.C.I.R.A. EXPERIMENTAL CUPOLA of the balanced-blast type is put into commission.

AT THE INVITATION of the Pig-iron Sub-Committee, the Blast-Furnace Committee of the Iron and Steel Industrial Research Council (British Iron and Steel Federation) nominates two representatives, these being Major H. H. Jackson and Mr. G. H. Johnson.

MR. JULIAN PIGGOTT, manager of the British Steel Export Association, represents the British steel industry on the industrial mission which the Federation of British Industries sends to Manchukuo.

September

THE INSTITUTE OF METALS holds its annual autumn meeting in Manchester.

THE IRON AND STEEL INSTITUTE holds its general meeting in Brussels.

ON RESIGNING his honorary treasureship, Sir Harold Carpenter, F.R.S., is nominated President-Elect of the Iron and Steel Institute.

MR. JOHN LONGDEN is appointed principal teacher in moulding and foundry practice at the new Trades' School in Glasgow.

THE NEW MAMMOTH CUNARDER, "Queen Mary," is launched at Clydebank by H.M. Queen Mary.

THE INSTITUTE OF BRITISH FOUNDRYMEN elects 16 new members.

THE INSTITUTE OF VITREOUS ENAMELLERS holds its first annual conference at Birmingham, under the chairmanship of Dr. J. W. Mellor. Mr. England reads the first Paper and the works of the Parkinson Stove Company is visited. Mr. H. L. Amery is principal guest.

October

MR. GEORGE BUCHANAN, M.P., is re-elected President of the United Patternmakers' Association.

MR. JOHN T. BATEY is installed as President of the North-East Coast Institution of Engineers and Shipbuilders.

THE INTERNATIONAL FOUNDRY CONGRESS is held at Philadelphia, U.S.A. Principal British delegates are Mr. James Smith (President of the National Ironfounding Employers' Federation); Mr. T. Makemson (secretary of the Institute of British Foundrymen); Mr. Spence Thomas (Vice-President of the Iron and Steel Institute); and Mr. Harold Jeans (chairman of THE FOUNDRY TRADE JOURNAL).

November

THE BRITISH CAST IRON RESEARCH ASSOCIATION holds its annual meeting and luncheon. Major Freeth is re-elected President.

THE COUNCIL OF THE IRON AND STEEL INSTITUTE elects as Vice-President Dr. W. H. Hatfield, D.Met., and Sir William J. Larke, K.B.E. Lieut.-Col. Sir Maurice H. L. Bell, Bt., C.M.G., is elected an Honorary Vice-President.

DR. HORMANN VON SCHRENK is elected to the office of President of the American Society for Testing Materials to fill the vacancy caused by the death of Mr. W. H. Bassett.

SIR ANDREW RAE DUNCAN, M.A., LL.D., is appointed independent chairman of the Executive Committee of the British Iron and Steel Federation.

DR. MELLOR resigns his position as Principal of the North Staffordshire Technical College.

LORD MELCHETT presents in the House of Lords a Bill entitled "Industrial Reorganisation (Enabling)"

FOR THE FIRST TIME in history, a joint meeting is held between two branches of the Institute of British Foundrymen. East Midlanders were guests in London. They visited the Ford Foundry at Dagenham, dined together at the Cheshire Cheese, and held a technical session at the Charing Cross Hotel.

MR. ALEXANDER RAMSEY, O.B.E., is elected chairman of the National Employers' Federation of Great Britain, in succession to Sir Alan Smith, K.C.

December

MR. ARTHUR HENDERSON, P.C., an honorary member of the Institute of British Foundrymen, is awarded the Nobel Peace Prize.

MR. W. R. BLAIR presides over the annual dinner of the British Ironfounders' Association.

SIR BERKELEY SHEFFIELD, BT., a director of Southern Foundries, is principal guest at London Foundrymen's Dinner. A complimentary dinner is offered to Mr. and Mrs. C. E. Williams by the South Wales and Monmouth Branch of the Institute of British Foundrymen.

WEDDING BELLS.—Miss E. Christine Elliot, honorary secretary of The Institute of Vitreous Enamellers, becomes Mrs. Kenneth Hill.

The Isolated Foundry

(*Concluded from page* 22.)

An Unexplored Territory

As a rider to the above generalisations, the writer has noted with interest that the Institute of British Foundrymen in general holds its conferences at Glasgow, North-East Coast, Sheffield, Manchester, East Midlands, Birmingham and London, yet the West country can show in its villages four modern foundries, possessing national if not international reputations, which because of their isolation are never likely to be visited. Yet paradoxically neither distance nor expense has prevented co-operative organised visits being made by parties of Britons to foundries in Philadelphia, Prague, Barcelona and Milan.

It might be assumed from his writings that the Author has an axe to grind, but this is not the case. It is just the result of the Editor asking for an article on the position occupied by the isolated foundry and an effort to dispel the notion that all foundries not situated in or about the large cities enter the category of country jobbing shops possessing an early Victorian atmosphere, but are in many cases the most advanced and up-to-date in plant and highly-organised production facilities.

The Pig-Iron Industry in 1934

By E. J. FOX (Managing Director of the Stanton Ironworks Company, Limited)

I AM able to give a better account of the pig-iron industry during 1934 than during any recent year. At the beginning of the year 1934, 81 furnaces were in blast, whilst we are now blowing about 96.

Production of pig-iron has increased from 4,140,000 tons during 1933 to about 6,000,000 tons this year (1934), and the production exported has also increased. The production of 1934 is the best since 1930, but has not yet returned to the level of 1929 (7,590,000 tons), to say nothing of 1913, when 10,260,000 tons of pig-iron were produced. In those days, however, our exports were greater at 1,150,000 tons; some of it to the Continent, but much of it to India and other countries, which to-day are making their own iron.

The increased production this past year is due largely to the increased home demand, following the increased requirements of iron for steelmaking purposes and for the engineering industries, both of which industries have benefited from the protection given in 1932, as also from depreciated sterling, which has assisted the steel and engineering export markets.

There is still much room for expansion, and if the steel industry is granted the further protection which was promised, the demand for pig-iron for steelmaking purposes will further increase during the coming year.

That the steel industry is not yet effectively protected is evident from the fact that imports of iron and steel this year will amount to about 1,400,000 tons; in other words, imports have been reduced by little more than one-half.

The Ottawa Agreement

The benefit of the Ottawa Agreements to India is evident from the fact that of 123,000 tons of pig-iron imported into this country during 1934, no less than 107,900 tons came from India, the remaining imports being represented largely by special irons from Sweden, much of it made from charcoal, or in electric furnaces.

Whilst, however, the Ottawa Agreements have undoubtedly been of benefit to India, it must be admitted that such benefit has been of some embarrassment to Scotland, where, owing to the low freights in operation between India and the Clyde, the largest proportion of Indian iron has come home to roost. Other districts that have imported Indian pig-iron are the Mersey and South Wales.

In spite of Indian imports, however, the Scottish pig-iron industry has shown a revival during the past year (with a production of 396,900 tons) of over 80 per cent. over the production of 1933.

The North-East Coast continues to give the largest output of pig-iron of any district in the Kingdom, and has produced this year 1,693,300 tons, compared with 1,063,100 tons last year.

The Midlands district produces largely for foundry purposes, and, taking this to cover Staffordshire, Worcestershire, Warwickshire, Nottinghamshire, Derbyshire, Leicestershire, and Northamptonshire, it has produced 1,492,200 tons, which is not very far short of the North-East Coast output.

The productive capacity of the Midlands has been increased during the past year by the addition of two modern furnaces at Wellingboro', and the first of these will come into operation during January, 1935: these two furnaces taking the place of three small furnaces which were dismantled some two years ago. The re-arrangement and remodelling of the furnace plant at Corby has also resulted in substantially increasing the production of pig-iron mostly designated for steel-making purposes.

The West Coast has been almost exclusively concerned with the production of hematite pig-iron: and their output has increased from 512,700 tons in 1933 to 673,700 tons for 1934.

Raw Material Market

I have said that from the production point of view the pig-iron industry in 1934 has been the most satisfactory since 1930; but it must be admitted that profits have not been commensurate with these increased outputs, largely due to the increasing costs of raw materials following partially on the increased output of iron.

MR. E. J. FOX.

The price of Durham blast-furnace coke, for instance, has risen from 16s. per ton in December, 1933, to 17s. 6d. at November, 1934, whilst South Wales coke has risen from 18s. per ton to 20s. per ton.

The following table shows the position at a glance of pig-iron production in the United Kingdom compared with other countries for the years 1903, 1913, 1923 and 1929 to 1934.

TABLE I.—*Production of Pig-Iron (in millions of tons).*

	1903.	1913.	1923.	1929.	1930.	1931.	1932.	1933.	1934 partially estimated.
United Kingdom ..	8.94	10.26	7.44	7.59	6.19	3.77	3.57	4.4	6.00
Canada	0.27	1.02	0.91	1.16	0.81	0.47	0.16	0.26	0.40
India	—	0.21	0.61	1.40	1.18	1.07	0.91	1.07	1.20
Australia	—	0.05	0.33	0.46	0.31	0.38	0.19	0.34	0.50
Germany	8.66	16.49	4.86	13.19	9.54	5.97	3.87	5.19	8.75
Saar			1.00	2.07	1.88	1.49	1.33	1.57	1.75
Luxemburg	1.20	2.51	1.38	2.86	2.43	2.02	1.93	1.86	1.90
France	2.79	5.12	5.34	10.20	9.88	8.07	5.45	6.22	6.05
Belgium	1.20	2.45	2.11	3.98	3.31	3.15	2.74	2.70	2.85
Russia	2.42	4.55	0.31	3.95	4.90	4.30	6.20	7.06	10.20
Poland			0.51	0.69	0.47	0.34	0.20	0.30	0.35
Sweden	0.50	0.72	0.30	0.52	0.49	0.41	0.28	0.35	0.50
Italy	0.07	0.42	0.27	0.66	0.53	0.50	0.45	0.51	0.50
Czecho-Slovakia ..	?	?	0.80	1.62	1.42	1.20	0.56	0.49	0.60
Spain	0.31	0.42	0.39	0.74	0.59	0.47	0.30	0.33	0.45
United States	18.01	30.97	40.36	42.61	31.75	18.43	8.78	13.35	15.80
World total	45.73	77.90	68.71	97.35	79.20	55.02	39.69	48.77	61.29

Comparing 1934 with 1933, it will be seen that whilst British production has increased by nearly 50 per cent., production in Germany increased by 68 per cent., and in America by 18 per cent. Production in Belgium and Luxemburg was practically stationary, and in France actually declined. The output in Russia shows the substantial increase of 44 per cent.

In 1929, Great Britain produced 8 per cent. of the world output of pig-iron, whilst this year it will produce roughly 10 per cent.

It will also be seen from Table I that whereas the United Kingdom held the second position in 1903, it was but fifth in 1933. And whereas in 1913 the United Kingdom supplied 90 per cent. of the pig-iron produced in the British Empire, the corresponding figure for 1933 was but 71 per cent. and the estimate for 1934 is but 74 per cent.

Table II indicates development of British Empire output compared with other countries over the last four decades:—

TABLE II.—*Production of Pig-Iron (in millions of tons).*

	1903	1913.	1923.	1933.
British Empire ..	9.21	11.54	9.29	5.81
Other countries ..	36.52	66.36	59.42	42.96
World total ..	45.73	77.90	68.71	48.77

It is interesting to examine in Table III exactly how the relationship of the different kinds of pig-iron manufactured in the United Kingdom has varied during the past few years.

In view of the increasing uses to which steel is being put, including demands for ferro-concrete and the motor trade, it is not surprising to find that this past year shows an increase in the production of basic iron actually and relatively.

Prophecy is always of more interest and perhaps help than retrospect—although certainly more dangerous—and a few words in this direction may be of interest.

So much depends on the continuation of the peace of the world that it is difficult to forecast with reasonable safety the pig-iron industry for 1935, but given peace, there is every reason to expect an improvement in the pig-iron trade. The Government of this country can be depended upon to safeguard the home market, and the Trade Agreements recently made should provide some benefit to the trade, although the requirements of the countries concerned are not relatively large.

Export Position

Exports of pig-iron have increased from rather more than 100,000 tons in 1933 to about 120,000

tons in 1934. The chief foreign markets for our pig-iron to-day are Italy, Belgium, Denmark, France, the Netherlands, South Africa, Canada, British Malaya, Irish Free State and Argentina. Little further expansion can be forecast in the face of serious competition from India and Japan in the Middle and Far Eastern markets, and the requirements of our own Dominions are being largely met by local production. In this connection it must not be forgotten that our iron- and steel-producing Dominions are likely to be future competitors of this country in the supply of pig-iron to our other Dominions and Colonial markets, at present supplied from this country.

TABLE III.—*Production of Pig-Iron by Kinds*, 1929–1934.

	All kinds.	Forge and foundry.	Hematite.	Basic.	Alloys and other qualities.
1929	7,589,300	1,828,400	2,347,900	3,196,500	216,500
	(100)	(24)	(31)	(42)	(3)
1930	6,192,400	1,786,700	1,841,000	2,407,600	157,100
	(100)	(29)	(30)	(39)	(2)
1931	3,772,600	1,381,400	879,200	1,435,500	76,500
	(100)	(37)	(23)	(38)	(2)
1932	3,574,000	1,173,700	793,900	1,550,100	56,300
	(100)	(33)	(22)	(43)	(2)
1933	4,136,000	1,054,500	1,107,500	1,910,900	63,100
	(100)	(25)	(27)	(46)	(2)
1934	4,957,400	1,125,900	1,256,600	2,466,800	108,100
(first ten months)	(100)	(23)	(25)	(50)	(2)

Influence of Scrap Market

This whole subject of pig-iron leaves one other important consideration to be taken into account and that is the supply of scrap for steel-making purposes. A shortage of steel-making scrap would bring about a greater demand for pig-iron, but it is felt in some quarters that a regular supply of steel scrap at prices below the price of pig-iron is essential if export markets for steel are to be retained. In any case, the probability is that, owing to the excess of shipping, much of which is likely to become scrap, and the tendency to modernise plant during this period of trade improvement, the scrap position will not change materially during 1935.

As I mentioned at the beginning of this article, prices of raw materials have increased; and the tendency is upwards. It must be expected, therefore, that during 1935 prices of pig-iron must follow the increase of raw materials and also tend upwards.

The Non-Ferrous Metals in 1934

(By Our Metal Exchange Correspondent)

LIKE most of its predecessors, 1934 failed to conform to the lines laid down for it by the prophets, falling short in some respects and excelling in others. As far as this country is concerned, trade has been on the whole good, and, generally speaking, the trend has been upwards all the time, a great deal of this improvement being due to the operation of tariffs and the protection thereby afforded to our own home industries. The Budget was frankly a disappointment at the time of its presentation, but as events have turned out it must be confessed that the Chancellor showed wisdom and courage in keeping concessions within bounds which appeared to the man in the street unreasonably strict. Our credit to-day stands high, and sterling, although still unanchored to gold, is the most stable currency in the world.

In the United States the year just closed marked a further period of struggle to raise commodity prices and to adjust wages and labour conditions, and looking back over twelve months one can say that some progress has been made; but conditions in the States are still very far from satisfactory, and President Roosevelt has still a big task in front of him. Nevertheless, affairs in that country are considerably better than in many other lands, for the situation in Europe is extremely uncertain. France, Holland, Belgium and Switzerland have managed to continue on the gold standard throughout the year, but their difficulties are very great, and it remains to be seen how long the struggle can be carried on successfully. The desperate economic plight of Germany has, however, had the biggest effect on the non-ferrous metal situation, for her withdrawal as a purchaser has been the cause of a severe setback in values, with the exception of tin. As the new year opens we are faced with a situation of uncertainty in Europe, which makes sanity of outlook and a spirit of good will more than ever necessary at this moment if peace is to be maintained.

Copper Curtailment Plans

Outstanding features in the copper situation during 1934 were the excellence of the rate of consumption in this country, the virtual disappearance of Germany as an important buyer, and the existence of persistent reports that a scheme of world curtailment would be initiated. With regard to the first there is little doubt that we have been getting business at the expense of other countries, especially Germany, so that the total of copper consumption has not been helped. German buying declined materially after the first four months of the year, but that country has been taking very fair quantities, even so, and the position is perhaps not so black as it has been painted. With regard to curtailment, the prospects of a discussion seem to be appreciably nearer, but the difficulties are obvious and a settlement is not going to be easy. Naturally, much depends upon the course of values during the next few months, for should a rise occur and be maintained, we shall not hear much more about cutting down production.

Last year opened on an optimistic note in copper, the price of standard being £32 5s. and of electro £36 10s., while in the States the domestic quotation was 8¼ cents delivered Connecticut Valley. The outlook seemed favourable for continued expansion of consumption, for at the ruling quotation the red metal was obviously cheap by comparison with its rivals. By the end of January, standard had appreciated to £33 15s., while the official L.M.E. quotation for wire bars stood at £37 10s., but by the time February had run its course there was a fall of 25s. For months and months negotiations in regard to the adoption of a copper code in the United States had dragged on, but first one difficulty arose and then another, so that it seemed as if the arrangement would never go through. Finally, at the end of April the Administrator himself forced a somewhat complicated measure upon the industry.

Waning Optimism

Looking back, one can see that by the end of the first quarter of 1934 the spirit of optimism which had ushered in the New Year was ebbing. Early in April, Germany announced the necessity of putting an embargo on imports of copper, and, although at first it was thought that this would be only of brief duration, subsequent developments have proved how seriously this decision has depressed the market. Then the signing of the code fell flat as a bull point, for, with the announcement that non-Blue Eagle would be on offer, it became evident that two separate and different quotations would obtain in New York, and that much of the non-Blue Eagle metal would have to find a home across the seas. May saw a revival of rumours about curtailment of output, and there was also talk of a world cartel, but far-sighted operators saw danger ahead, and the London standard market began to show distress, as bear operations developed on a large scale.

In mid-June the American domestic price was advanced by 50 points to 9 cents, but not before consumers had helped themselves very liberally and secured cover for many months ahead. Moreover, the export price in New York was only 8 cents, c.i.f. European ports, and by the end of June the London market, under pressure of persistent hedging sales, had declined to £31 5s. for standard and £34 15s. for wire bars. By this time it was fairly obvious that matters were shaping badly for copper, but with demand keeping up so well in the U.K., speculators were encouraged to buy and hedging sales continued. Another adverse factor now made its appearance, for the American Custom smelters, unable to get rid of their non-Blue Eagle copper at home, and finding but a limited outlet in Europe, began to sell forward on the London warrant market and to ship in fulfilment, a practice also adopted by Chile. The inherent strength of London as a centre of copper trading now became apparent, for these sales were absorbed without any complications, but the price had to suffer, and in mid-July standard stood at £29 10s., with electro £3 10s. higher. British consumers were now fully alive to the dangers of the situation, and had adopted a policy of hand-to-mouth buying, which only served to make matters worse, although general usage in this country continued to be very good. Demand in the United States was poor.

At the beginning of August a further fall of 15s. had occurred, and talk of the possibility of long-term credits for the purchase of copper being extended to Germany by America did nothing to check the fall. September brought the usual talk of an autumn revival, but as far as this country was concerned, it was fairly obvious that little room for improvement existed. On 'Change, selling pressure continued, and with buyers rather reluctant, the steady decline persisted through September, when, in the

middle of the month, standard was £27 5s. and electro £30 12s. 6d., the export price in New York being 6.625 cents f.a.s., compared with 9 cents domestic. Not unnaturally, American buyers were doing very little at this level. The bottom of this disastrous setback in copper values was reached about the middle of October, when standard copper in London was quoted at £25 12s. 6d. and wire bars at £29 5s., the market showing every indication of going still lower. In America the export figure stood at a discount under the domestic price of nearly 3 cents, for Custom smelters were selling at 6.17½ cents f.a.s. New York.

A Change for the Better

As usually happens, the turn from abject pessimism to super-optimism came with dramatic suddenness, but the recovery was very short-lived, for it was based on a measure of further curtailment by primary producers in the States, which was presumed to be the prelude to general action by mines in other parts of the world. Such an assumption was quite unjustified, but for a few days speculators, encouraged by inspired rumours, lost all sense of proportion, and to give some idea of the volume of business passing, it may be noted that in the week ending October 26 the turnover in standard copper was about 16,000 tons. The extent of this rise was about £4, although the highest recorded quotations were £29 for cash standard and £32 5s. for wire bars on October 29, after which the sudden withdrawal of speculative interest pricked the bubble, and values came down very suddenly. Although at the beginning of the recovery consumers rather held back, they came in eventually, and a very big business was done, many buyers contracting for some months ahead, but the sequel to this has been a period of quiet trading, with a measure of hand-to-mouth purchasing by the trade.

The reaction in copper prices did not, however, take values back to the original low level from which the rise began in October, for expectations obtained, backed up by the knowledge that unofficial meetings between producers were taking place in London, and that an agreement on the vexed subject of curtailment would be reached in the early days of this year. The year, therefore, closed on a fairly optimistic note, for, while it is realised that the obstacles to a world agreement are very great, the alternative, *viz.*, cut-throat competition amongst the producers with a policy of going all out in a production race, seems to be unthinkable. It is to be hoped that these expectations will be realised, but experience has taught us not to be too optimistic in regard to negotiations between copper producers.

Tin Control made Absolute

Outstanding features of the tin situation last year were the setting up of the tin pool and the establishment of a complete control on the position by the International Committee. As from January 1, the quotas were increased to 40 per cent., the total visible supply at that time being some 26,500 tons, or less than half the figure of twelve months earlier, while by the end of the year a further shrinkage took place to about 18,000 tons. Throughout the greater part of the year a backwardation, varying from 10s. to £3 10s. per ton, was in evidence, and at one time (May) stocks in this country were below 4,000 tons. Broadly speaking, the rate of consumption of tin was good during the first half of last year, but deteriorated, especially in the United States, from June onwards, the rate of usage in the tinplate industry varying between 40 and 60 per cent. throughout the twelve months.

Last year opened with the price at £227 2s. 6d. for cash, with a contango of about 7s. 6d., but by early February a backwardation had made its appearance, although there was not much change in the price. By mid-March £236 10s. was the ruling quotation, a rise having taken place on the strength of better February statistics, and by the end of the month £239 2s. 6d. had been reached. Early April saw the Buffer Pool mooted and a decision that quotas should not be increased took the price up to £241 10s. for cash, the backwardation then being 30s. In the early days of May the market was startled by an announcement that quotas would be increased by 10 per cent. and the quotation broke by £5, but some recovery occurred. In mid-June, when details of the Pool were announced, the quotation was no better than £226 5s., but sentiment improved later in the year, the price in December being nearer £228.

By the end of August it was fairly apparent that consumption of tin was declining, and the International Committee therefore announced that as from October 1 the quotas should come back from 50 to 40 per cent. This action checked the downward trend, and during the concluding months of last year the market was steady to the point of dullness, for speculative interest was quite dead and the control by the International Committee was absolute. In the opinion of most people the price of tin was kept too high throughout 1934, but for the moment there is no indication of any change in policy during this present year.

Lead Position Unsatisfactory

During the first part of last year the L.M.E. quotation did not decline much below £11, and actually during the second half of January there was a rally to £11 16s. 3d. At July 31 the price was at £11 1s. 3d., but on September 11 it touched £10 and during December it was but little above this level. Consumption in this country has been excellent and imports for the year are round about 300,000 tons, a figure very much higher than 1933. For the most part the expansion in building activity was responsible for this satisfactory state of affairs, but during the second half there was an increase in demand from the cable manufacturers, whose call is, nevertheless, still well below normal. The falling off in demand from Germany has, of course, seriously upset the lead situation, for that country has always been a big consumer of this metal, and although matters look a little more promising than they did, the outlook is not too good for the immediate future.

An unfortunate feature of the lead position here last year was the maintenance of a stiff premium for Empire metal, which is, of course, the only lead coming in free of duty, all foreign metal being subject to 10 per cent. *ad valorem* tax unless lodged in bonded warehouse. Moreover, supplies of duty-free lead have proved unequal to the demand, and in consequence consumers have been obliged to look a long way ahead and to cover sales by purchasing future arrivals at a relatively high contango over the spot price. This is not at all satisfactory, and so serious has the situation become that consumers are taking joint action to endeavour to obtain redress for their grievances, but so far it cannot be said that much improvement has been manifested.

Spelter Troubles and Anomalies

In many respects the spelter situation last year was similar to lead, for duty-free metal, particularly of G.O.B. quality, was scarce during the latter half of the year, and, in order to secure cover, buyers were compelled to purchase for forward delivery. So severe was the shortage that foreign metal was taken ex-warehouse on payment of the duty, while Empire brands were marketed at a price equal to the L.M.E. quotation plus 10 per cent. duty. This is an unfortunate state of affairs and one quite contrary to the spirit of the Ottawa agreement, but, as with lead, there seems to be little prospect of any relief for the consumers.

The year opened with the quotation at £14 12s. 6d., which by the third week of January had climbed to £15 2s. 6d., the first five months showing a fluctuating market approximately between these levels. The inception of the German embargo, however, and adverse reports regarding the future of the cartel, brought a sharp decline to £13 at the end of July and, in spite of a recovery in the following month to £13 17s. 6d., a further reaction ensued, the market being shaken by further bad news concerning the future of the cartel and the starting-up of the Magdeburg refinery in Germany. Early in October the quotation stood at £11 15s., but the rally in copper during that month improved sentiment and spelter recovered to £13, only to fall away again so disastrously that a low record for the year was set up in December. On the whole, 1934 was a bad year for everyone connected with spelter, and it is much to be hoped that during 1935 ways and means will be found to correct the troubles and anomalies which are checking business.

Czecho-Slovakian Foundry Industry

(*Concluded from page* 23.)

So far as the workmen are concerned, no difficulties with regard to the wages arose in 1934. The working condition varied; there were no important discharges of workmen this year. Foundries which were not fully occupied have discharged their workmen for limited periods or lowered the number of working hours. Towards the end of the year some foundries of the engine builders worked with the normal number of hours.

Discharges of technical and administrative staffs, which was so apparent in 1933, ceased in 1934 completely. In fact, towards the end of the year, a demand for technicians, engineers and foremen was definitely apparent, due no doubt to the improvement in sales. Some foundries, in fact, went on full time. No improvement in prices has been registered, but rather the contrary. There are, however, signs that a more reasonable understanding of the situation will, before long, bring, at least in some branches of the foundry industry, an end to insensate price-cutting. It is now clearly to be seen that, apart from its sad aspect, the crisis had some good influences, and that all that was unhealthy in the foundry industry has been healed or will be dissipated, and thus the old, well-founded plants will be able to work more quietly and with a greater understanding of the necessity for mutual collaboration.

The units of foundry industry were not equally affected by the crisis. The worst hit were those in districts which are remote from the principal raw-material-producing centres, such as Vitkovice.

The percentage increase of production during the year 1934 of the Czecho-Slovakian foundries compared with the end of 1933 is as follows:—Grey-iron machinery castings, about 10 to 50 per cent. and more; builders' castings, about 10 to 35 per cent.; malleable castings, about 10 per cent.; and steel castings, 20 per cent.

In Czecho-Slovakian foundry circles it is considered that the crisis is past, and, if nothing unexpected happens, the curve of production will rise next year.

IT IS REPORTED from Warsaw that arrangements have been completed through the Mitsui Company for the export to Japan of 7,000 metric tons of Polish zinc at a price equal to about £11 a ton, compared with the present inland price of about £20.

THE 10,000,000 TONS of pig-iron provided for in the Russian plan for this year were produced by the middle of December. It is 48 per cent. more than last year's production, and amounts to 17 per cent. of the world's total annual output. Blast furnaces in operation total 114.

Recent Developments in the French Foundry Industry

By MAURICE OLIVIER (President, French Foundry Employers' Federation)

UNQUESTIONABLY the most outstanding feature during 1934 was a meeting held on January 27, when about 450 foundry-owners decided to reorganise their Employers' Federation under the presidency of the writer. This has been an arduous task, and much remains to be done before a complete corporation can be established uniting the brass, light alloy, malleable and steel foundries of the type which is now in being in Italy, and which took something of the order of seven years to perfect.

The reorganisation of the *Syndicat Général des Fondeurs de France* was essential, as the French foundry industry was suffering very severely from four main factors—unstable currencies abroad, dumping, insurmountable tariff walls and disproportionate cost prices in the various European countries, but above all incessant price-cutting was experienced in many sections of the trade. The choice of the writer, as President of the reorganised *Syndicat Général Fondeurs de France*, was because of his active association with the Northern Foundry Employers' Federation. This District Association has experienced two particularly brilliant and active periods; the first was from 1919 to 1924, when work was plentiful and the organisation complete. Then, certain founders with small capital set themselves up in business—a natural corollary of any period of prosperity. This gave some members an excuse for leaving the organisation and the establishment of a free market. Disaster overtook them in a few days, as there was a violent drop in sales price. As soon as this happened the writer retired until 1926, when he patiently awaited the outcome. The Northern foundrymen were quickly disheartened through working without any hope of profit; they felt demoralised when they examined their balance-sheets and realised that this so-called liberty had paralysed their industrial efforts. It was under these conditions that they again asked me to take charge of their co-operative efforts. Thus, the second period started in 1926 and remained an authoritative body until 1931. Then, as always without the support of appropriate legislation, the breaking of rules restarted. Quite recently a third effort has been made, but in this case it is essential to extend the organisation to cover district after district until every foundry owner is embraced within one vast organisation.

As an outcome of the meeting of January 27, 1934, five District Associations were immediately formed. The first section, centred in Flanders, included the foundries of Dunkerque, Calais, Boulogne and Saint Omer, and covered the castings required for shipbuilding, saw mills, preserve factories, paper mills and other industries. The second district included Lille, Roubaix, Tourcoing and Armentières, which makes general engineering and textile castings. The third division was for the area of Arras and Bethune, which covered mining castings. The fourth, centred at Valenciennes, was to take care of railway castings, whilst the last one had as its headquarters, Maubeuge, where machine tools are made. For each division a foundry owner has been established as a leader. It is the duty of each District President to meet, at regular intervals, all his colleagues; to examine at fixed periods the financial standing of their customers; to discuss the markets for pig-iron and scrap; to regulate wage levels; to establish and maintain selling prices at an economic level; and, above all, to smooth out any ill-feelings which may arise between his colleagues in the district.

It was decided at this meeting (January 27, 1934) that co-operative buying should be undertaken on behalf of the organised foundrymen and that a sales commission of 5 per cent. should be taken towards the costs of the organisation of the National and District Federations. Moreover, it was established that the National Association should give its financial support to the Paris Foundry High School and to a Research Association which has just recently been established and is now open, and, possibly, towards the expenses of running foundry exhibitions. This commission, coming from the co-operative purchase of pig-iron, would be augmented by similar commissions arising from the supply of scrap and possibly other raw materials.

MR. MAURICE OLIVIER.

The writer felt that it was his duty to show the meeting that whilst such co-operative measures as have been adopted introduced undoubted benefits to the participants, it also brought about a corresponding number of duties; for instance, it was essential that their organisation must not be a brake on progress. It must be realised by those firms which, by means of capital expenditure on new plant or by the intelligent application of new systems are in a position to lower the general price level for a given article, that their saving must be shared with the ultimate consumer. There must be no selling of castings below cost price, even though dozens of reasons can be put forward to justify it being done in exceptional cases. There must be no searching for methods of evading the spirit of the rules postulated for the benefit of the industry. A real effort has to be made to gain the sympathy and, finally, the close co-operation of the five different categories of mentalities found within the industry; these individuals comprise those who are definitely convinced of the benefits of co-operation, waverers, sympathisers, indifferent persons, and the intractables. A realisation that these types of individuals exist makes it desirable that an effort be made in France to obtain legal power to compel the recalcitrant minorities to come into line. Otherwise, steps will have to be taken amongst themselves to obtain some sort of redress.

British readers will realise that France, being on the gold standard, finds that it is exceptionally difficult to carry on any export business, as the major portion of the buying countries throughout the world adhere to sterling. Whilst Britain recognises the intense competition experienced from Japan in the export markets of the world, this factor is still more onerous to the silk and cloth manufacturers in France, which, of course, acts indirectly on the textile foundry industry situated around Lille.

There is a body of opinion in France which imagines that a second inflation would be helpful towards the re-establishment of French industry, but the author, who has spent much time and thought on this particular problem, is definitely against such a step being taken, and would prefer to base his hopes for the rehabilitation of French industry on the creation of a system of corporative life in industry, but not along the same lines as have been established in Italy; such a system does at least ensure for the industrialists that the home market shall be profitable, and a clearer conception is immediately afforded as to what can be done by way of export.

During the year there has been some amelioration in French industrial life, but the lack of a proper fixed policy, based on a sound economic footing, by the Government, has not been helpful.

Finally, the writer asks his British colleagues in the foundry industry to accept his assurance that, at all times, he and his colleagues are only too willing to co-operate for the general good of the foundry industry as a whole.

We Acknowledge

with sincere thanks the receipt of the following Christmas gifts and heartily reciprocate the good wishes which accompanied them:—A week-to-the-page diary from *The Stanton Ironworks Company;* an ash tray in the form of a shield (possibly the arms of Rochester) cast in Meehanite metal from *Winget, Limited;* a miniature tear-off monthly calendar from *Macor & Coulson, Limited;* a pocket diary, four days to the page, containing a mass of useful data for the foundry industry from *British & Continental Traders, Limited;* a daily tear-off wall calendar from *Ashwell & Nesbit;* a monthly wall calendar carrying illustrations of the works from *Smith & Fawcett;* a wall calendar carrying three months to the page from *Craven Bros.;* a desk writing pad and calendar from *The British Chilled Roll & Engineering Company;* a monthly wall calendar carrying an illustration of a young lady sun bathing from *H. Hendra & Son;* a monthly wall calendar carrying a striking illustration of the head of a Red Indian from the *Carborundum Company;* a desk calendar of exceptionally neat design from *Stewarts and Lloyds;* a waistcoat-pocket diary, four days to the page, with provision for holding a season ticket, from *I.C.I. (Metals), Limited;* a waistcoat pocket diary carried out in blue sealskin from *J. Stone & Company, Limited;* a pocket diary, seven days to the page, and an inset carrying a mass of technical data from *The Staveley Coal & Iron Company, Limited;* a pocket diary, carrying four days to the page, a series of well-printed maps and a host of data about refractories from *John G. Stein & Company;* a pocket diary, four days to the page, and containing 70 pages of high-grade engineering data, such as logs and the like, from *Frank*

(Concluded on page 34.)

The Italian Foundry Industry

By Dr. Ing. GUIDO VANZETTI (President of the Italian Steelfoundry Owners' Federation)

[In an Interview.]

BECAUSE of absence from Europe in connection with the Philadelphia International Foundrymen's Congress, no time has been available for the preparation of an article, and the following notes are based on an interview which it is hoped will be equally satisfactory. In general, these remarks apply to the steelfoundry industry. The output of steel castings this year should reach something of the order of 58,000 metric tons, as against the 40,000 which were produced last year. In general, the price level has been somewhat less than that existing in 1933, but during the last few weeks there has been a distinct improvement, and it is considered that January 1, 1935, will still show a slightly lower level than twelve months previously. Whilst very serious efforts have been made during the last twelve months to push along with the organisation of a *corporazione*, no effort has been made to institute any real system of price maintenance, though it is expected that this will have the attention of the appropriate committee in the near future. Much consideration has been given to conditions of labour, and a 46-hr. week has been instituted. As there is a definite shortage of skilled moulders and patternmakers in Italy, it is frequently found impossible to avoid the working of overtime. Where this occurs, a 5 per cent. surcharge is imposed, and this money is paid over to the credit of the unemployed. This considerable increase in output amongst the steelfoundry owners is due to the increased volume of orders which have been placed by railway companies, shipbuilders and building trades, as well as the increase in the requirements of the military and naval authorities. It may be a matter of interest for British readers to learn that when the *corporazioni* are finally constituted, representing as they do every industrial activity and professional organisation, they will replace entirely the Chamber of Deputies; thus, political representation in Italy will be upon a trade and professional basis instead of geographical.

During the year the Vanzetti Milan Steel Foundry Company has made the first high-frequency furnace installation in Italy. This is a matter of "history repeating itself," as the direction of this firm was responsible for carrying out the original experiments with both the "Stassano" and "Basanesi" furnaces. The electrical equipment is of 250 k.v.a., 1,720 Hertz and 1,300 volts, and three different-sized bodies are available to meet the varying demands of the foundry. At the moment these have capacities of 50, 250 and 400 kilos. As trade warrants there is ample capacity in the motor-generator set to install bodies of still greater capacity. Already several other orders have been placed in Italy, and it is thought that this furnace will soon assume a very important position in Italian steel metallurgy.

DR. ING. GUIDO VANZETTI.

During the year a considerable amount of attention has been given to the institution of specifications for both iron and steel castings. At the moment tentative specifications are now in the hands of the various interested parties, such as the steel-foundry owners, the Admiralty, War Office, railway companies, and other important buyers. The system adopted for steel has been to divide the ordinary carbon steel into three main classes. The first is ordinary commercial material, from which no mechanical tests are required. The second is good ordinary-quality steel, and is divisible into three categories. The tensile requirements range from 24 to 33 tons, with elongations diminishing from 20 to 12 per cent., tests being taken on a bar of which the length is five times the diameter. In general, no impact tests are required for this particular range of castings, with the exception of the railway companies, who are still seeking for the inclusion of these. The figures range from 5 to 3 k.g.m. per c.m.^{2} The third main category is for high-quality steel. The tensile requirements are of the same order, but higher elongations are demanded; they diminish from 25 to 16 per cent. In addition, these high-quality castings steels also carry impact tests diminishing from 8 to 5 k.g.m. per 2 c.m.^{2}. It is also specified that the sulphur and phosphorus content must not exceed individually 0.06, or together 0.1 per cent.

Grey-Iron Specifications

For the purpose of defining the properties of grey iron, a tentative specification was inculcated last June. There are the usual clauses, prohibiting direct blast-furnace metal and correlating the bar with the casting in reference to chemical treatment and mould conditions. Five categories have been established, from the lowest of which no tests are required, whilst the others carry a tensile range starting at 9.5 and terminating at 16.5 tons per sq. in. Transverse tests of a corresponding character have been laid down; the distance between supports is 600 mm. The bars are to be cast vertically, two in a mould; they are 650 mm. long by 30 mm. diameter. A two-part box is used, the drag being perforated for venting. The drag,

(*Concluded on page* 32.)

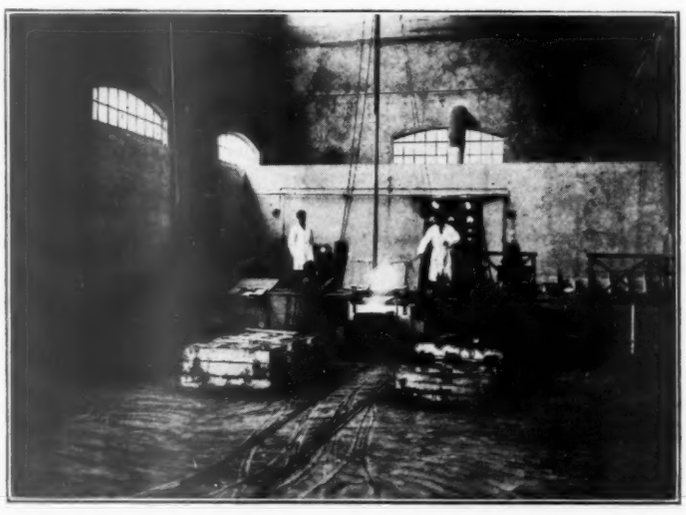


FIG. 1.—THE NEW HIGH-FREQUENCY PLANT INSTALLATION AT MILAN STEEL FOUNDRY.

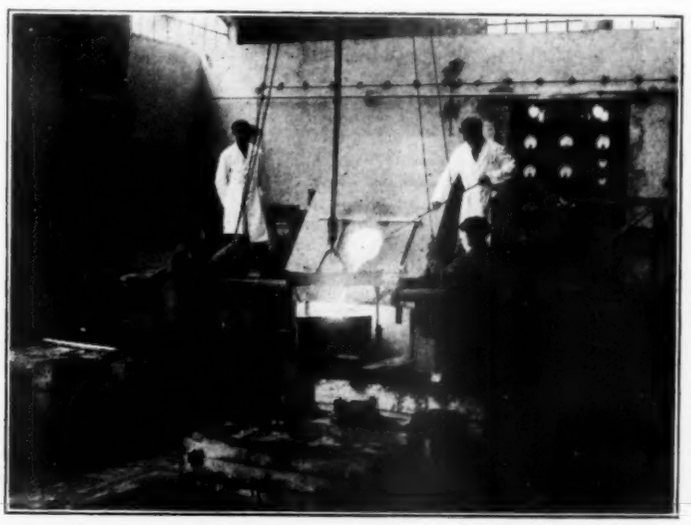


FIG. 2.—TEEMING THE HIGH FREQUENCY SHOWN IN FIG. 1. IT IS THE FIRST PLANT TO BE INSTALLED IN ITALY.

The Light Castings Industry in 1934

By A. W. STEVEN (Chairman, Allied Ironfounders, Limited)

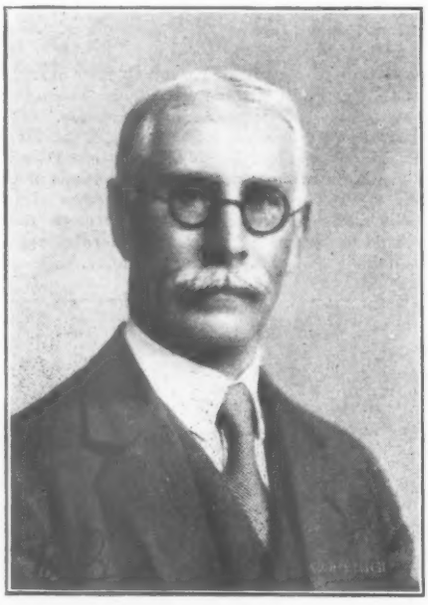
DURING 1934 the light-castings industry has experienced, on the whole, favourable trading conditions. The expansion in demand which set in during 1933 has been well maintained, with the result that in all branches output has been somewhat greater in volume than during any year since the slump in 1929.

The industry, taken as a whole, is capable of satisfying all the demands which have been made upon it, and could cope with an output considerably in excess of what has so far been required. At one time a large proportion of production found an outlet in export markets. That proportion has unfortunately been very much reduced, but has at last shown signs of recovery. Many countries which in the past were buyers of British castings are now producing not only their own requirements but are competing at low prices in those few markets which are still open to British traders. Owing to credit and exchange restrictions purchases from the latter countries are still seriously restricted. The industry cannot, therefore, rely on any immediate or important increase in sales to countries overseas.

Exports of Builders' Castings from the United Kingdom for the last Nine Years.

Year.	Tons.	£
1925	19,141	873,761
1926	19,668	882,118
1927	17,929	829,644
1928	19,682	876,745
1929	20,522	928,274
1930	17,852	796,865
1931	13,972	620,457
1932	10,536	442,894
1933	12,968	537,014
1934*	(*a*) 8,105	396,015
	(*b*) 2,776	80,573

* These figures are for the eleven months ended November 30, 1934. (*a*) represents stoves, grates and ranges for domestic cooking and heating, and (*b*) sanitary cisterns (flushing tanks).



MR. A. W. STEVEN.

Economy Cuts Restored

Throughout the year employment has been reasonably good. The records of men employed show some advance on those of 1933. Fortunately, the relations with workmen have been maintained on the same excellent footing which was established some years ago, and the employers have found it possible to restore in full the reductions in wages conceded by the men during the worst period of the slump.

Firms, long established in the trade, have found increased competition from goods composed of new materials, and from firms who have entered the trade, some with new types of goods and others with copies of existing designs. The industry has, however, shown great enterprise in producing new patterns in great variety and at competitive prices, probably without advantage to its shareholders and proprietors.

Exports of Cast Pipes and Fittings from the United Kingdom for the last Nine Years.

Year.	Tons.	£
1925	94,251	1,348,900
1926	86,984	1,148,758
1927	122,823	1,495,251
1928	114,189	1,321,662
1929	136,107	1,455,202
1930	116,305	1,294,041
1931	72,776	804,930
1932	65,635	671,439
1933	86,327	834,153
1934*	91,026	887,892

* These figures are for the eleven months ended November 30, 1934.

So many varying conditions in commercial, economic and political affairs, few of which can be foreseen, influence the prosperity of an industry, that it is impossible to foretell with accuracy the course of business in the coming year. Apart, however, from any serious adverse development which may upset the present equilibrium, prospects are favourable for the maintenance of employment among workers and a fair measure of prosperity for the owners.

The Steel Foundry Industry in Australia

By L. M. GAUSSEN (Foundry Manager, Vickers Commonwealth Steel Products Limited, New South Wales)

RECENT reports from Australia indicate that business during 1934 has shown an improvement, and consequent upon Federal Election results in September, a period of steady trading conditions is expected with confidence. Moreover, increased activity in the mining fields and heavy iron and steel has had considerable bearing on the market.

The demand for castings and alloy steels continues to be strong, and examples in 20 per cent. chrome steel, weighing up to 3½ tons approximately, having been dealt with.

The electric furnace continues to be most generally favoured as a melting medium. Normally it is basic lined and operated on lines similar to those generally obtained in Great Britain. Typical figures for power consumption range from 660 to 900 units per ton melted, depending on the furnace capacity. Refractories of good quality are available within the Continent, and results obtained from them bear comparison with European practice. Electric furnace roof-lives of 135 heats and upward are reported. All ferro-alloys are imported, and the graphite electrodes, which are generally used, also come within this category.

Australian Railway Specifications

The majority of steel foundries have installed chemical and physical laboratories, as a thoroughgoing metallurgical control is essential to meet modern requirements and fulfil the specifications issued by the Standards Committees. Railway specifications are in general more severe than those ruling in the United Kingdom, and include minimum acceptance clauses for reduction of area and Izod impact values. The more recent installations for the heat-treatment of steel castings have been equipped for oil firing.

Turning now to the moulding side of industry, the sands in use at present are very varied in character, but no castings are made in "compo." In Victoria and South Australia, natural loams are available, and used "let down" with silica sand, whilst in Sydney, N.S.W., friable rock, high in silica, is also used as a base for facing mixtures. At Newcastle, N.S.W., and in Western Australia synthetic sands have been developed and used with some success.

The standardised equipment of the American Foundrymen's Association is mostly used for sand testing. It was selected by the Sands Committee of the Australian Bureau of Steel Manufacturers for a co-operative research scheme undertaken some years ago.

On account of the relatively restricted field, no serious attempts at mechanisation of handling have been made. Foundry equipment is brought from America, the Continent of Europe and the home country, a preference being shown for American designs of moulding machines Pneumatic auxiliary tools are extensively used.

Wages are controlled by Courts of Industrial Arbitration, the present rate for skilled moulders being £4 16s. per week of 44 hrs., subject to adjustment for different conditions of engagement. Labour throughout the country is well organised.

Until this year the recruitment of apprentices has been most difficult on account of the stringency of conditions imposed upon the employer. Recent legislation has done much to improve this situation, and recruitment under organised training schemes is now in progress.

The character of castings made in Australia varies over a wide range of weight, from pieces weighing ounces only to a limit of those castable with the output of two 30-ton open-hearth

(*Concluded on page* 32.)

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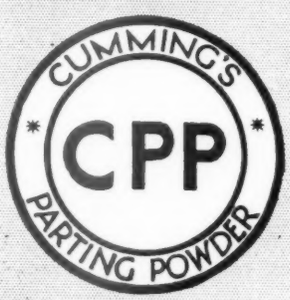

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American Foundry Industry in 1934

By D. M. AVEY (President of the American Foundrymens' Association)

THE entire calendar year of 1934, viewed in retrospect, may be characterised as a transition period. Definite indications point to the emergence of the foundry industry from the depression era and the first slow steps toward business recovery. The National Industrial Recovery Act in its application to the foundry industry, although still in the state of trial and error, has wielded an influence upon employment, foundry practice, and prices. Certain trends in broadening the market for foundry products have been evidenced. Remarkable accomplishments in technical lines and in the development of new machinery and equipment have been unveiled.

National Industrial Recovery Act

The National Industry Recovery Act, passed in 1933, did not become effective in the foundry industry until the completion of the code formulation marked by the approval of the grey iron industry code on February 26, 1934. This was the last of four basic codes applying to the steel, malleable, non-ferrous, and grey iron branches of the foundry industry. In addition, a multiplicity of codes applying to specialities such as pipes, furnaces, ornamental work, and ranging along the line to piston rings, gives indication of the complications attending the codification of the foundry industry. The immediate effect of shortening hours in available labour supplies was not in evidence, due to the current low rate of operation. However, indications point to an early shortage of skilled foundry labour. The increase of base labour rates applying not only to common labour but to higher brackets, has had an influence, not only with the foundries directly, but upon all the equipment and commodities purchased and used by foundries. Although some of the foundry codes have provisions tending to stabilise prices, the probable immediate effect has been due more to the evident increase in cost, carrying the painful lesson that higher prices must obtain. The continuance of many features of NRA depend upon policy determinations by the Government that still are beyond the power of prophecy.

Finding New Fields

With the lessening of demands upon the time of leading foundry executives, noted in late '33 and early '34, by the turmoil of NRA complications, more attention has been given to broadening outlets and finding new fields. Some of this shifting and aggressive business policy has been evidenced by changes within the foundries themselves; for example, a machine-tool foundry equipping to manufacture automotive parts, a stove shop taking on lawnmower work, and changes of this sort which carry no additional tonnage for the industry. Contrasting directly with this is the evident alertness with which foundries, individually and collectively, are seeking to extend the field of service for castings. A definite trend is apparent which will reclaim certain types of work previously made by the foundry industry and even displace other materials and other types of manufacture. A case in point is the general return of all automotive brake drum work from the field of pressed metal to castings. The preceding year saw the successful application of castings to automobile camshaft manufacture. During 1934 early development work led to the commercial application of the cast crankshaft, a wider use of cast tappets or valve lifters, and the entirely new development of completely cast automotive valves.

Steel or Cast Iron?

The largest manufacturer of low-priced automobiles is equipping all cars with a cast crankshaft in which the carbon spread of 1.25 to 1.40 per cent. gives rise to an argument as to whether the metal is cast iron or cast steel.

Wider application of alloys to grey iron, malleable, steel, and non-ferrous casting is apparent. Much of the development work carried on in the depths of the depression is finding application in entirely new lines. This is typified in larger uses of nickel, molybdenum, chromium in grey iron and with wide experimental study of the effect of copper additions.

During the past several years many radical changes have been made in foundry equipment. Perhaps the most noteworthy strides have been in pressure blasting, in exhausting and ventilating, in moulding and in sand preparation. The field of cleaning castings has been productive of some radical innovations. The development of new and harder material for sand-blast nozzles, the application of the centrifugal principle to throwing abrasives against the work by mechanical action and the delivery of exceedingly large quantities of abrasives through large openings by a moving air current rather than compressed air, all have emerged during the preceding year.

MR. D. M. AVEY.

Similarly, greater attention to the problem of proper ventilation based upon a definite desire to reduce dust hazard has brought some interesting innovations. The complete exhausting of blast equipment, shake out, grinding, and other equipment identified with castings production has caused much new foundry construction. Dust-collecting equipment has been improved, even to the point of washing the air from collieries.

Core-Blowing Machines

In moulding, some sort of application of the compressed-air principle of supplying sand, familiarly known as core blowing, has been noted. Refinements in moulding equipment, including the commercial application of automatic timing devices for regulating both the jar and squeeze operations, is a definite development of 1934.

In the field of sand conditioning, new light units for riddling and aerating sand have been introduced. Refinements also have been made in instruments for sand testing and in the design of light durable flask equipment.

Melting Practice

The low rate of foundry operation has brought greater attention to melting economy, while the close control and refining effect available has given an impetus to the use of electrical melting units in grey iron and non-ferrous as well as in steel foundries. Much attention is being given to all types of melting which will serve to improve quality of product, to facilitate alloying or special treatment. In this connection, a recent combination of cupola and converter melting by which the cupola metal is ladle-mixed with a low-carbon, low-silicon product from the converter is attracting some attention.

The International Congress

The Fifth International Foundry Congress, under the auspices of the American Foundrymen's Association, held in Philadelphia, during October, emphasised the turn in the tide of American foundry morale. The presence and participation of representatives of the foundry industry from overseas, undoubtedly, stimulated interest in this Convention and Exhibition. It was apparent from the increase in attendance, the greater interest emphasised by foundry management and, finally, by the unusual presentation of new equipment and supplies, that the American foundry industry once again is awake and vitally aggressive in striving for better practices and products.

The Italian Foundry Industry

(*Concluded from page* 29.)

150 mm. deep, carries a common pouring basin for the two bars, the runners into the bar being 15 mm. diameter. The tensile bar is of the short variety, the nicked portion being only 22 mm. long. The diameter is 20 mm.

As is usual, there has been very prolonged negotiations for the establishment of these specifications, but this year should see the adoption of what is now provisionally proposed.

Italian foundrymen, who send their cordial greetings, are always willing to co-operate with their *confrères* in other lands for the betterment of conditions, both commercial and technical, within the industry.

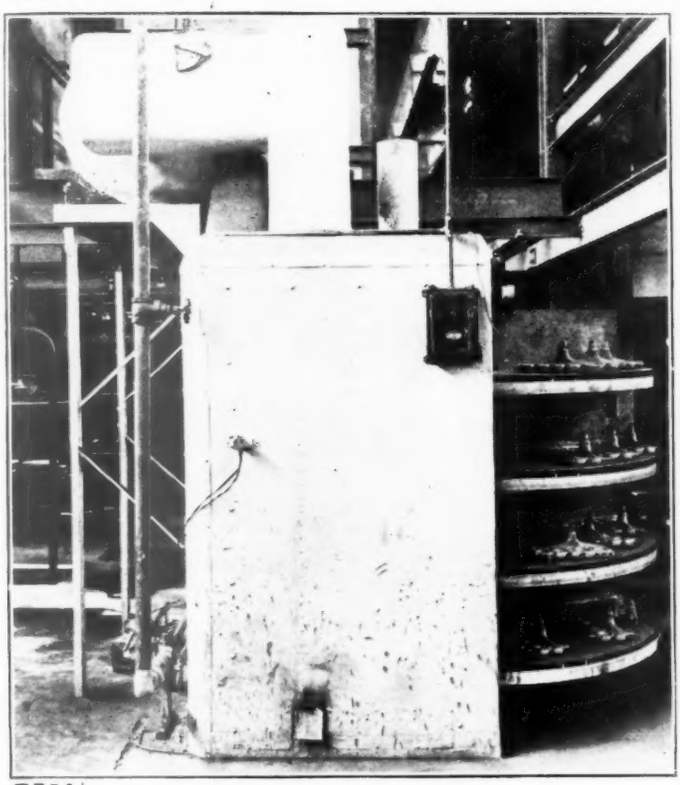
The Steel Foundry Industry in Australia

(*Concluded from page* 30.)

furnaces. Furnaces are available with a much larger capacity than these, should occasion arise to use them on foundry work.

Broadly, the industry is equipped to deal efficiently with a considerable range of products, and as engineering and railway construction improves, satisfactory conditions should be firmly established.

THE CLAIM of the engineering unions for an increase of wages was presented to the employers at a conference in London last week. Application was made for an advance in wages of 2d. an hour, with an equivalent advance to pieceworkers.



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CARGO FLEET MIDDLESBROUGH

This Week's News in Brief

Trade Talk

A SERIOUS FIRE OCCURRED recently at the works of Messrs. Matthew Harvey, Glebeland Works, Bath Street, Walsall. As the main works, offices and warehouses were unaffected, business will be carried on as usual.

THE IMPORT DUTIES ADVISORY COMMITTEE are to conduct an inquiry into the working of the present arrangements regarding the supplies and prices of lead and zinc, and the provisions of the Ottawa Agreement in that connection.

MR. N. P. INGLIS, of Imperial Chemical Industries, Limited, Billingham, spoke at a meeting of the Tees-side Branch of the North-East Coast Institution of Engineers and Shipbuilders, on December 20, on "Some Metallurgical Aspects of Certain Recent Industrial Developments."

IMPROVING BUSINESS and an increase of 27 per cent. in sales for the year have necessitated extensions to the Acme wringer factory at Glasgow, covering two acres. The work is nearing completion, and the firm hopes to begin production in the new buildings before the end of January.

BIRMINGHAM ELECTRIC FURNACES, LIMITED, Birlec Works, Tyburn Road, Erdington, Birmingham, have acquired from the Detroit Electric Furnace Company, of U.S.A., the sole manufacturing rights in the Detroit rocking electric-arc furnace for the British Isles, Dominions and certain other countries.

THE CLYDE SHIPYARDS stopped work on December 29 for the New-Year holidays, and in most yards work will be resumed on January 7. At Messrs. John Brown & Company's yard, Clydebank, it is expected that a considerable number of men will resume earlier, so as to have a torpedo boat ready for departure on January 8.

MESSRS. COCHRANES (MIDDLESBRO') FOUNDRY, LIMITED, have sub-licenced the Stanton Ironworks Company, Limited, near Nottingham, to use the Mairy patent process in connection with the centrifugal casting of pipes. It will be recalled that Cochranes acquired some years ago from Belgium the sole British rights for the use of this process.

MESSRS. WILLIAM DENNY & BROS., LIMITED, Dumbarton, have booked an order from the Australasian United Steam Navigation Company, Limited, for a single-screw motor-vessel, 200 ft. in length. The propelling machinery, consisting of Burmeister & Wain type Diesel engines, will be supplied by Messrs. Kincaid & Company, Limited, Greenock.

THE MEMBERS of the staff and a few friends of Mr. J. B. Ballantine, managing director of New Grange Foundry Company, Limited, were entertained to dinner in Roman House, Bo'ness, on Christmas Eve, when Mr. Ballantine presided. The chairman extended a cordial welcome to the guests. The foundry, he said, had had a most successful year, and he hoped that there would be fresh activity after the New Year to keep the moulding shops in steady employment throughout the spring and summer months.

MESSRS. WILLIAM BEARDMORE & COMPANY, LIMITED, Dalmuir, have received a substantial order for Diesel engines, which, following upon the recent order for 'bus engines for Glasgow Corporation, will keep the works employed for some time. The firm have been receiving many inquiries recently, and it is expected that further contracts will be booked in the near future. The marine-engine works at Dalmuir are to close as soon as present contracts are completed, but the production of high-speed Diesel engines and Caprotti valve gear will be continued. At the moment plans are being prepared for the reorganisation of works and plant.

A SPIRIT OF OPTIMISM was apparent at the closing-down of the light-castings foundries in the Falkirk area, on December 28, for the New-Year holidays. No general date for resumption has been fixed, but the volume of orders made it necessary for some of the plants to restart yesterday, whilst some will remain closed until January 7. The improvement in the industry which set in at the end of 1933 has been maintained and advanced during 1934, to such an extent that manufacturers are able to report 1934 as a year of exceptional progress and the outlook for 1935 as unusually promising. During the past year most of the local foundries have undergone reorganisation and modernisation, wholly or in part, and machinery has been brought into line with modern principles of production and finish and to meet the demands for quicker delivery.

Personal

MR. H. WINTERTON, Junior Vice-President of the Institute of British Foundrymen, has been elected a Bailie of Milngavie, Glasgow.

MEMBERS OF THE instrument department of Glenfield & Kennedy, Limited, engineers, Kilmarnock, met last week to honour Mr. J. Gray on the occasion of his retiring, after 55 years' service.

MR. AND MRS. WILLIAM NAYLOR, of Trent Road, Blackpool, celebrated their golden wedding anniversary on Boxing Day. Mr. Naylor was one of the founders of Brown & Naylor, brassfounders, of Batley Carr, Yorkshire. He retired from the business in 1917.

MR. SAM MAVOR, managing director of Messrs. Mavor & Coulson, Limited, engineers, Glasgow, is to retire from that position at the end of the year, but will retain the office of chairman of the company. Mr. J. B. Mavor, a son of the founder of the firm and a nephew of Mr. Sam Mavor, will become managing director.

MR. JOHN M. COLVILLE, works manager of Messrs. Colvilles, Limited, Dalzell Steel Works, Motherwell, and younger son of the late Mr. Archibald Colville and Mrs. Colville, of Arngomery, Kippen, was married in New York, on December 28, to Miss Helen Markillie, of San Francisco. The staff and workers of the Dalzell works presented Mr. Colville with some pieces of silver plate to mark the occasion.

ON THE OCCASION of his retirement, after 35 years' service with the Grangemouth Iron Company, Limited, Falkirk, Mr. Alexander Haig, foreman engineer at Grange Foundry, was made the recipient of gifts from the firm and the foremen. Mr. J. M. Primrose, managing director, handed to Mr. Haig, on behalf of the firm, a wallet of Treasury notes, whilst on behalf of the other foremen Mr. Haig was presented with a wireless set.

Wills

DARBY, ALFRED, of Flint, a director of the old Brymbo Steelworks Company ... £13,675

REES, F. J., of Llanelly, managing director of the Llanelly Steel Company (1907), Limited, President of the Royal Metal Exchange, Swansea, and chairman of the South Wales Siemens Steel Association £37,866

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

416,116. FOUNDRY EQUIPMENT, LIMITED, CORRIE, J. B., BEECH, A. S., FIELDING, F. B., and ROWLES, R. V. Foundry moulding machines and the like.

416,119. WEBER, K. Process for casting metal articles centrifugally.

416,125. DEMAG AKT.-GES. Machines for straightening metal and like bars.

416,158. BOSQUI, F. L., and RHOKANA CORPORATION, LIMITED. Production of ferro-cobalt.

416,179. HANUS, E. Case-hardening.

Recent Developments in the French Foundry Industry

(*Concluded from page* 28.)

Wigglesworth & Company, Limited; a leather book marker from *George Castle;* an extremely pretty wall calendar from the *Morgan Crucible Company;* a desk diary, eight pages to the day, interleaved with blotting paper, from *H. G. Sommerfield, Limited;* a refill for a day-to-day tear-off desk calendar from the *Demag Company,* a leather-bound pocket diary from *S.A. Silica,* and a calendar with a pleasing picture of a girl's head beautifully reproduced on silk from *W. & J. F. Jones, Limited.*

Obituary

MR. WILLIAM ADAMSON, a director of Wailes Dove Bitumastic, Limited, Hebburn-on-Tyne, and manager of the firm's London office, has died, aged 47.

MR. JAMES GORDON HUTTON, who was for 33 years on the staff of Messrs. Alex. Shanks & Son, Limited, engineers, Arbroath, died recently, at the age of 73.

MR. JAMES ROBERTSON, of Messrs. James Robertson & Company (Glasgow), Limited, ironfounders, Coxhill Ironworks, Glasgow, died recently at Duncryne, Coltpark, Bishopbriggs.

MR. JOHN CLARK, who began work at Carron Iron Foundry when he was a youth, and recently completed his 72nd year with the firm, died recently. In spite of his advanced age, he was still at work until a day or two before his death.

THE DEATH OCCURRED, in a Glasgow nursing home on December 20, of Mr. Robert Wright, who for 55 years was in the employ of Messrs. Smith & M'Lean, Limited, Gartcosh, and Mavisbank Works. Mr. Wright, who retired a few years ago, was 81 years of age.

MR. GEORGE H. SANKEY, High Sheriff of Staffordshire, who died recently at his residence, Astley Abbotts, Bridgnorth, aged 67, was the second son of the late Mr. Joseph Sankey, who founded the firm of Joseph Sankey & Sons, Limited, of Bilston and Hadley (Shropshire)—now a branch of Guest, Keen & Nettlefolds, Limited. He became its managing director and was very well known in business circles in the Midlands. He had been connected with the Albert Street Works, Bilston, for half-a-century. He was a magistrate for the county, sitting at Bilston, and had served on the committee for the Wolverhampton and South Staffordshire district of the Royal Metal Trades Pension and Benevolent Society.

MR. FRANCIS JAMES BALLARD, of Messrs. F. J. Ballard & Company, Limited, enamelling stove manufacturers and engineers, of Tividale, Tipton, died on Sunday, December 23, aged 58. Mr. Ballard was also chairman of Messrs. Edward Wright & Company (Stourbridge), Limited, Victory Foundry, Stourbridge, governing director of the Cradley Chain & Manufacturing Company, Limited, and a director of other companies. He gave much time and energy to the public affairs of Dudley. He was elected to the Town Council in 1912 for Netherton Ward, and, with the exception of a few months in 1915, he held his seat continuously until March, 1929, when he was elected an alderman. In 1927 he was elected Mayor, serving in that capacity for two years.

A NEW HARDWARE CONCERN, to be known as Hardware, Limited, has been registered in the Free State, with a nominal capital of £15,000 in £1 shares. The company will acquire as a going concern the hardware merchants' business formerly styled the Cork Hardware Company. The new company's directors are Mr. J. H. Atkins, The Cottage, Dunmanway, County Cork, Mr. M. Atkins, and Mr. J. Moffat, Buxton House, Dubdays Well Road, Cork.

Forthcoming Events

Institute of British Foundrymen

JANUARY 5.

Lancashire Branch:—"The International Foundry Conference in the United States," Paper by T. Makemson at the Engineers' Club, Albert Square, Manchester, at 4 p.m.

Wales and Monmouth Branch:—"Bronze Castings," Paper by E. J. L. Howard at the Technical College, Newport, at 6.30 p.m.

JANUARY 8.

Burnley Section:—"The Making of High-Duty Irons," Paper by G. Hall at the Municipal College, Ormerod Road, Burnley, at 7.15 p.m.

JANUARY 9.

Preston Section:—"The Moulder and his Craft," Paper by C. A. Otto at the Technical College, Corporation Street, Preston, at 7.30 p.m.

London Branch:—"Some General Remarks on Mechanised Foundries and the Making of Motor Cylinders," Paper by G. W. Brown, M.I.Mech.E., at the Charing Cross Hotel (First Floor), London, W.C.2, at 8 p.m.

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Raw Material Markets

The volume of activity in the iron and steel trades is still much reduced, holiday influences prevailing in Scotland, and to a certain extent on the North-East Coast. The majority of the producing works, however, are viewing the temporary slackening with equanimity, as they are heavily sold over the first part of the New Year. In addition, the 1934 output of iron and steel was the heaviest for the past five years.

Pig-Iron

MIDDLESBROUGH.—The opening of a new year has been attended by a spirit of optimism in the Cleveland iron market. With heavy forward order-books, the ironmasters will experience no inconvenience from the small stocks accumulated during the stoppage. Some fairly substantial contracts have been booked with Scottish consumers for the first quarter of 1935 at the preferential rates which are still quoted to buyers North of the Tweed. Thus, while consumers in the Middlesbrough area still have to pay a delivered price of 67s. 6d. per ton for No. 3 Cleveland G.M.B. and 69s. 6d. per ton on the North-East Coast, the same grade of iron is being delivered to the Falkirk foundries for 67s. 3d. and in the Glasgow area for 70s. 3d. per ton. The usual premium of 2s. 6d. per ton is charged for No. 1 foundry iron, and No. 4 foundry and No. 4 forge quotations are still 1s. per ton less than No. 3.

At the present low prices, there is a strong demand for East Coast hematite, such that holidays have had to be curtailed or abandoned altogether at many works in order not to interfere with production. Quotations continue to be based on 69s. per ton for No. 1 quality, delivered to consumers in the Middlesbrough area.

LANCASHIRE.—The pig-iron market in this area is giving signs of settling down quickly to satisfactory conditions. The outlook with regard to prices is one of continued steadiness. For delivery to users in the Lancashire zone, offers of Staffordshire and Derbyshire brands of No. 3 foundry are on the basis of 74s. per ton. Northamptonshire at 72s. 6d., Scottish foundry at around 82s. 6d., East Coast hematite at from 75s. to 76s., according to quality, and West Coast material at about 78s. 6d.

MIDLANDS.—Some of the ironfoundries in this area restarted work last Thursday, but a general resumption was not made until Monday. The opening months of the year are expected to see a satisfactory demand for pig-iron, but there are still fairly heavy stocks to dispose of at the furnaces. The controlled prices delivered this area for Midland brands of iron, No. 3 grade, are 67s. 6d. for Northants and 71s. for Derbyshire, Lincolnshire and North Staffordshire. The prices for special irons used in the engineering trade are not controlled in any way and vary according to analysis. Irons in the low-phosphorus category are priced between 85s. 6d. and 87s. 6d., Scottish at about 85s., and medium-phosphorus iron 72s. 6d. to 80s., with refined iron £5 7s. 6d. to £6 10s., per ton delivered this district.

SCOTLAND.—The ironworks have remained closed this week for the annual holiday, and the movement of iron has been stopped until a resumption is made next week. In the absence of trading, prices are unchanged, and the official minimum of 70s. for No. 3 foundry, f.o.t. furnaces, still stands, with an extra 2s. 6d. per ton for No. 1. In the light-castings section of the trade, prospects for reopening after the holidays are good. There is no alteration in the official quotations for No. 3 Cleveland iron, viz., 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow.

Coke

Owing to holiday influences and the fact that the majority of consumers have bought ahead until March, there has been little in the way of new buying of cupola coke. Quotations for delivery in the Birmingham area remain as follow:—Best Durham coke, 36s. to 40s.; other grades, down to 34s.; Welsh coke, 35s. to 45s. per ton.

Steel

Business has not yet been fully resumed in the steel markets, but it is usually the middle of January before normal conditions rule after the Christmas and New Year holidays. Few transactions have been reported in the semi-finished steel department, as most users covered their requirements over the early part of the New Year before the holidays commenced. The producing works have a considerable tonnage of orders in hand, and are likely to be well employed for some time to come. In the finished-steel section, business has developed upon satisfactory lines. Export business is quiet, although there has been a considerable volume of inquiry. The producers are well provided with orders, and a substantial home demand is already making itself felt.

Scrap

Dealing in scrap iron at the various centres throughout the country has been of a desultory nature over the holidays, but consumers have again begun to show interest and prices are generally firm. Good cast-iron machinery scrap is quoted at 53s. 6d. per ton in the Cleveland area, at 55s. in the Midlands and in South Wales, and at 55s. to 56s. 3d. per ton in Scotland.

Metals

The London Metal Exchange was closed on New Year's Day.

Copper.—The demand for copper has naturally been rather limited during the past week, the majority of manufacturers being in the midst of stocktaking. Nevertheless, there has been a fair amount of dealing of a speculative nature on the London market. The future of this metal largely hinges upon the question of restriction of output. It is now doubted whether the proposed international meeting of producers in New York will actually take place.

Daily prices have been :—

Cash.—Thursday, £28 3s. 9d. to £28 5s.; Friday, £28 1s. 3d. to £28 3s. 9d.; Monday, £28 5s. to £28 7s. 6d.; Wednesday, £28 6s. 3d. to £28 8s. 9d.

Three Months.—Thursday, £28 12s. 6d. to £28 13s. 9d.; Friday, £28 10s. to £28 11s. 3d.; Monday, £28 13s. 9d. to £28 15s.; Wednesday, £28 15s. to £28 16s. 3d.

Tin.—There is little or no change to report in conditions in the tin market, quotations remaining very steady. The close of the year saw a slight downward trend in the consumption of tin in this country. Whether this tendency will continue or be checked remains to be seen when holiday influences are finally shaken off. On the other hand, recent reports from the United States indicate that the tin-consuming industries in that country have lately experienced a burst of activity.

Day-to-day fluctuations :—

Cash.—Thursday, £228 2s. 6d. to £228 5s.; Friday, £228 2s. 6d. to £228 7s. 6d.; Monday, £228 7s. 6d. to £228 12s. 6d.; Wednesday, £228 7s. 6d. to £228 10s.

Three Months. — Thursday, £228 5s. to £228 7s. 6d.; Friday, £228 5s. to £228 7s. 6d.; Monday, £228 5s. to £228 7s. 6d.; Wednesday, £228 5s. to £228 7s. 6d.

Spelter.—Owing to the holidays and stocktaking operations, the consumptive demand for spelter fell away considerably, but the market has, nevertheless, been fairly firm, in spite of the break-up of the Cartel. The effect of the latter happening had already been largely discounted. The scarcity of Empire metal for early delivery continues, and the supply position is to be investigated by the Import Duties Advisory Committee.

Official quotations :—

Ordinary.—Thursday, £11 12s. 6d.; Friday, £11 15s.; Monday, £11 17s. 6d.; Wednesday, £12.

Lead.—The position of the lead market is also to be examined by the Import Duties Advisory Committee, the Empire producers apparently being unable to supply fully the needs of the English market.

Daily fluctuations :—

Soft Foreign (Prompt).—Thursday, £10 8s. 9d.; Friday, £10 7s. 6d.; Monday, £10 13s. 9d.; Wednesday, £10 5s.

A Review of the Foundry Industry of 1934

(*Concluded from page* 2.)

dustry will look back on the present period as one of astonishing progress in the cast iron field, and metallurgists of the future will envy us the opportunity of opening up this relatively unknown territory. At the same time much remains to be done for what may be termed the ordinary foundryman. The progress in special irons, that is, specially strong irons or irons specially resistant to heat, wear, corrosion, and so forth, is creating a new section of the industry, but as yet a comparatively small section. The developments in moulding sands and their control are of greatest concern to the mechanised plants, which, like the specialised foundries, are increasing in number and importance, but which nevertheless are still only a fraction of the whole. The progress on enamelling interests is again an increasing but small section. The ordinary jobbing founder looks to such matters as shrinkage and contraction problems, and on fundamental matters relating to testing and design, for help. There remains finally a field of interest to all founders, irrespective of the nature of their product, and that is the cupola furnace. In spite of important recent developments we still await a convincing theory of operation of the cupola and a means of control, if such be practicable in the nature of the case, which will enable a founder to predict with reasonable certainty what he will get out of the furnace. We need not refer to the difficulties, which are well known, and the reasons for delayed attack on these matters are also well understood. In research, progress is made where it can be made, and in research, as in other affairs, discretion is sometimes the better part of valour. Wise control ensures that an attack is made on those things which offer reasonable prospects of success, and these we have mentioned as still awaiting solution are among the most difficult problems of a difficult industry. They will yield to systematic attack in the long run, for experience as well as skill is a great help.

Conclusions

Last year was important for the foundry industry in that it shared in the glamour of two very important events—the opening of the Mersey Tunnel and the launching of the "Queen Mary." It has been a year of quiet progress, consolidating step by step the opportunities offered by commercial and technical advancements. Recognition of its developments is being accorded by the engineering profession, and practically every section can look forward to 1935 with unqualified confidence. There are still black spots in the country, the derelict areas, but ripples from the wave of prosperity are bound to reach even the quietest and most remote corner of the industrial pond.

Company Reports

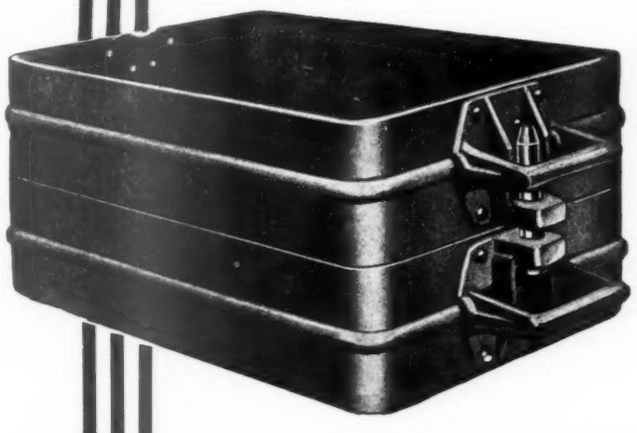
Hadfields, Limited.—The directors state that although the improvement in trade has been maintained they have decided to defer payment of the preference dividend due December 31.

Shotts Iron Company, Limited.—Brought in, £4,121; transferred from reserve, £5,000; transferred from income-tax account, being provision not now required, £6,500; balance at credit of profit and loss account for the year after providing for debenture and bank interest, £25,695; depreciation, £25,000; defalcations account, balance written off, £12,638; carried forward, £3,678.

THE VELSEN (Holland) municipal authorities have given the Kon. Nederlandsche Hoogovens en Staalfabrieken permission to build a foundry at that place, a development which is believed to be associated with the steelworks' plans for establishing tube mills.

STERLING MOULDING BOXES

are an essential part of the equipment of every up-to-date foundry



The Sterling Box is more than "just a Moulding Box," it is an accurate tool for producing accurate castings with a minimum of labour and effort

Made from solid ribbed rolled steel

STERLING FOUNDRY SPECIALTIES Limited
LONDON OFFICE:—13 VICTORIA STREET, S.W.1
AGENTS AT MANCHESTER, GLASGOW & NEWCASTLE-ON-TYNE.
BEDFORD

RAW MATERIALS—PRICE LIST

(Wednesday, January 2, 1935)

COPPER

	£	s.	d.
Standard cash	28	6	3
Three months	28	15	0
Electrolytic	31	10	0
Tough	30	5	0
Best selected	30	15	0
Sheets	58	0	0
India	41	15	0
Wire bars	32	0	0
Ingot bars	32	0	0
H.C. wire rods	34	15	0
Off. av. cash, December	27	17	6 5/19
Do., 3 mths., December	28	5	4 1/19
Do., Sttlmnt., December	27	17	10 1/19
Do., Electro, December	31	6	4 11/19
Do., B.S., December	31	0	7½
Do., wire bars, December	31	11	0 12/19
Solid drawn tubes			9½d.
Brazed tubes			9¾d.
Wire			6d.

BRASS

Solid drawn tubes	8¾d.
Brazed tubes	10¾d.
Rods, drawn	8d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	7d.
Wire	7d.
Rolled metal	6¼d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5¼d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	228	7	6
Three months	228	5	0
English	228	12	6
Bars	230	12	6
Straits	230	7	6
Australian (nom.)			—
Eastern	230	5	0
Banca	230	7	6
Off. av. cash, December	228	5	1 1/10
Do., 3 mths., December	228	11	7 1/19
Do., Sttlmt., December	228	5	0

SPELTER

	£	s.	d.
Ordinary	12	0	0
Remelted	13	0	0
Hard	10	10	0
Electro 99.9	14	12	6
English	13	0	0
India	12	0	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., December	11	17	5 3/38
Aver. spot, December	11	14	7 2/19

LEAD

	£	s.	d.
Soft foreign ppt.	10	5	0
Empire (nom.)	11	17	6
English	12	10	0
Off. average, December	10	8	1 1/19
Average spot, December	10	6	3 15/19

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex whse.	23	0	0
Rods	26	10	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	74	0	0	to	75	0	0
Chinese, ex-whse.					65	0	0
Crude						—	

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to	11	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	13 0 0
75%	18 7 6
Ferro-vanadium—	
35/50	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	29 15 0
4/6% car.	23 0 0
6/8% car.	21 12 6
8/10% car.	21 12 6
Ferro-chrome—	
Max. 2% car.	34 0 0
Max. 1% car.	38 15 0
Max. 0.70% car.	42 0 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	15	0	to	2	16	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to	2	12	6
Heavy cast iron	2	10	0	to	2	13	0
Good machinery					2	15	0
Cleveland—							
Heavy steel					2	11	0
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy cast iron					2	12	6
Heavy machinery					2	13	6
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					3	0	0
Steel turnings, f.o.r.					1	14	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	12	6
Engineers' turnings					1	19	0
Cast-iron borings					1	17	6
Wrought-iron piling	2	11	3	to	2	12	6
Heavy machinery	2	15	0	to	2	16	3

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	24	0	0
Brass	16	0	0
Lead (less usual draft)	9	10	0
Tea lead	6	10	0
Zinc	8	0	0
New aluminium cuttings	66	0	0
Braziery copper	19	0	0
Gunmetal	22	0	0
Hollow pewter	155	0	0
Shaped black pewter	115	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge.	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.	12	0	0				
Gas strip	10	10	0	and up.			
Bolts and nuts, ¾ in. × 4 in.	14	0	0	and up.			
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	9	5	0	to	9	7	6
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ½ in. (Untested)					8	12	0
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)					9	7	0
Black sheets, 24g. (4-t. lots)					10	10	0
Galv. cor. shts. (,,)					13	0	0
Galv. flat shts. (,,)					13	10	0
Galv. fencing wire, 8g. plain					14	10	0
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	0	0	to	5	7	6
Tin bars	5	2	6	to	5	7	6

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	11d.
Rods	10d.
Tubes	13d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/2 to 18/6
,,	28×20 ,,	36/4 to 37/-
,,	20×10 ,,	26/- to 26/3
,,	18½×14 ,,	18/6 to 18/9
C.W.	20×14 ,,	16/- to 16/6
,,	28×20 ,,	34/- to 35/-
,,	20×10 ,,	24/- to 25/-
,,	18½×14 ,,	16/6 to 17/-

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Dec.	27 ..	28	3	9	dec. 3/9
„	28 ..	28	1	3	„ 2/6
„	31 ..	28	5	0	inc. 3/9
Jan.	2 ..	28	6	3	„ 1/3

Standard Tin (cash)

		£	s.	d.	
Dec.	27 ..	228	2	6	inc. 5/-
„	28 ..	228	2	6	No change
„	31 ..	228	7	6	inc. 5/-
Jan.	2 ..	228	7	6	No change

Spelter (ordinary)

		£	s.	d.	
Dec.	27 ..	11	12	6	dec. 1/3
„	28 ..	11	15	0	inc. 2/6
„	31 ..	11	17	6	„ 2/6
Jan.	2 ..	12	0	0	„ 2/6

Zinc Sheets (English)

		£	s.	d.	
Dec.	27 ..	23	10	0	No change
„	28 ..	23	10	0	„ „
„	31 ..	23	10	0	„ „
Jan.	2 ..	23	10	0	„ „

Electrolytic Copper

		£	s.	d.	
Dec.	27 ..	31	12	6	inc. 2/6
„	28 ..	31	10	0	dec. 2/6
„	31 ..	31	10	0	No change
Jan.	2 ..	31	10	0	„ „

Tin (English ingots)

		£	s.	d.	
Dec.	27 ..	228	7	6	inc. 5/-
„	28 ..	228	7	6	No change
„	31 ..	228	12	6	inc. 5/-
Jan.	2 ..	228	12	6	No change

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Dec.	27 ..	14	6	3	inc. 1/3
„	28 ..	14	7	6	„ 1/3
„	31 ..	14	10	0	„ 2/6
Jan.	2 ..	14	12	6	„ 2/6

Lead (English)

		£	s.	d.	
Dec.	27 ..	12	10	0	No change
„	28 ..	12	10	0	„ „
„	31 ..	12	10	0	„ „
Jan.	2 ..	12	10	0	„ „

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1894	35 8	35 11	36 1	36 1	35 5	35 5	35 5	35 11	36 6	35 8	35 8	35 1	35 9
1895	34 7	34 4	34 4	34 8	35 6	35 2	36 1	37 1	38 10	38 6	37 11	37 6	36 3
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 6	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 9	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	99 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 3½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	65 9½
1929	66 0	66 9	67 0	68 1½	69 5	71 10½	72 9	72 6	72 6	72 6	72 6	72 6	70 4½
1930	72 6	72 6	70 0	67 6	67 6	67 6	67 6	64 6	63 6	63 6	63 6	63 6	66 11½
1931	59 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 7
1932	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6
1933*	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6
1934*	62 6	65 0	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	66 10½

* Delivered Middlesbrough area. Prior to 1933, prices were f.o.t. furnaces.

WILLIAM JACKS & COMPANY,
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Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-
(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

ADVERTISER seeks position as Manager, Assistant Manager or Foundry Foreman; 10 years' experience in similar capacity with well-known South Staffordshire foundry engaged in production of motor cylinders and accessory castings for motor trade.—Box 102, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN Coremaker required by well-known South Staffordshire foundry employing male and female labour, used to all modern methods of production and systems of control. Must be used to light and medium cores.—Apply, giving experience and salary required, Box 100, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Works Manager wanted: must be used to underground, rain-water, and soil pipes and connections. Able to fix piecework prices and control men. Immediate start. State age, experience and salary, and enclose copies of testimonials.—Address, "FOUNDRY," WM. PORTEOUS & COMPANY, Advertising Agents, Glasgow.

REPRESENTATIVES required throughout Great Britain for marketing chemical device applied by metal and iron founders. Liberal commission only.—Write, Box ZX 175, c/o DEACONS, 5, St. Mary Axe, London, E.C.3.

WANTED, Assistant Foundry Foreman, not over 35 years, used to high-class ferrous and non-ferrous pressure castings.—Full details to Box 994, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED, Foundry Manager to take complete charge of foundry producing ingot moulds and general castings. Applicants to give full particulars of experience, age and remuneration required.—Apply, Box 996, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

TENDER

ARMY CONTRACTS.

NOTICE IS HEREBY GIVEN that Tenders for Goods and Services of the kinds mentioned below are invited from time to time, as required :—

Metal Trades.

Aluminium ingot and castings, Brass, Brass rod and sheet, Bronze stampings, Copper ingot and sheet, Lead pig and sheet, Metal rod, Nickel, Pig-iron, Steel plate rounds, sheets, etc., Tin ingot, Tinplates, Tinned brass pressings and stampings, Zinc ingot and sheets, Baths, Bicycles, Building materials and fitments, Cooking apparatus, Cutlery (including safety razors and blades), Enamelled-ware, Forge-fittings, Grates with mantels, Hollow-ware, Horseshoes, Ironmongery, Machinery, Reinforcing metal, Stable fitments, Steel and cast-iron pipes, Stoves, Tinware (including canisters, etc., to precise dimensions), Tools, Tubular scaffolding, Vehicles, Wire, Wire rope.

Electrical and Scientific Instrument Trades.

Cables, Electrical plant, Electrical and Wireless stores, Scientific instruments.

Textile Trades.

Blankets and rugs, Braid and lace, Canvas and canvas goods, Clothing (made up from

Continued in next Column.

TENDER—*Continued.*

Continued from previous Column.

Department's own materials), Cotton piece goods and cotton goods, Cordage, Flannel (Union), Head-dresses, Horse rugs, Hosiery, Linen piece goods, Silk cloth and webbing and sewing silk, Towels, Woollen Cloths.

Foodstuffs, Coal and Coke.

Other Trades.

Badges and buttons, Basket-ware, Bedding, Boots and shoes, Brooms and brushes, Chemicals and oxygen and acetylene gases, China and earthenware, Furniture, Glazed-ware drain pipes, Harness and saddlery, Leather and leather goods, Linoleum, Medical supplies, Moulded rubber articles, Oil-dressed clothing, Oils and spirits, Paints and varnishes, Refractories (firebricks, etc.), Road materials, Rubber boots and clothing, Safety glass, Sanitary appliances, Shellac, Timber, Woodware.

Building Works, etc.

Jobbing, painting and repair work (including term contracts), New buildings, Heating and electrical installations, Erection of constructional steelwork, Reinforced concrete work, Road and drainage work, Roofing and flooring work, Construction of sports grounds, etc.

Firms who are not already on the War Office List of Tenderers, and who wish to be invited to tender for the above Army requirements as they arise, should apply in writing to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, London, S.W.1, for Form 1 (Form 1A in respect of the services mentioned under Building Works above), on which formal application for inclusion on the list of tenderers may be made. The services of an intermediary are unnecessary in approaching the Department for this purpose.

Before being placed on the lists of tenderers, firms will have to satisfy the Department that they actually manufacture goods or carry out services for which they wish to be noted, and will be required to furnish the names of at least two well-known firms or public bodies who have employed or purchased from them and are in a position to certify as to the quality of their work. They will further have to give an undertaking that they will comply with the Fair Wages Resolution of the House of Commons.

Attention is called to the following resolution passed by both Houses of Parliament on February 16, 1926 :—

"That, in the opinion of this House, it is the duty of the Government in all Government contracts to make provision for the employment to the fullest possible extent of disabled ex-Service men, and to this end to confine such contracts, save in exceptional circumstances, to employers enrolled on the King's National Roll."

Sales.

From time to time the Department has for sale surplus Army Stores of various descriptions, among which may be mentioned Boots, Clothing, Electrical and wireless stores, Explosives and chemicals (including drugs, ammonium nitrate and sodium picrate), Hutting, Machinery, Medical and dental stores, Motor vehicles and spare parts, Optical and scientific instruments, Scrap metal, Textile goods, Veterinary stores.

Firms who wish to be invited to tender for the purchase of surplus stores should apply in writing to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, London, S.W.1.

Sales of surplus stores by auction are also held at the Royal Arsenal, Woolwich, about the middle of January, March, May, July, September and November. Catalogues may be obtained from the Chief Ordnance Officer, Royal Arsenal, Woolwich, S.E.18.

No application is necessary from firms whose names are already on the War Office lists, unless they have extended the range of their manufactures.

F. C. BOVENSCHEN,
Director of Army Contracts.

AUCTION SALE

BY ORDER OF THE RECEIVERS FOR THE DEBENTURE HOLDERS.

Re WM. HAMMOND & COMPANY (SYSTON), LIMITED, Malleable Ironfounders, Syston, near Leicester.

PRELIMINARY NOTICE of SALE BY AUCTION of HIGH-CLASS IRON-FOUNDRY PLANT, MACHINERY and TOOLS, including Cupolas, Blowers, Sand Screens, 30 Moulding Machines, 70 Tons of Cast and Steel Moulding Boxes, Pneulec-Royer Sand-Thrower, Centrifugal and Vertical Mixers, Grinders, Stone-Breakers, Grinding Spindles and Wheels, Bogey Ladles, Rumblers, Petrol- and Electric-driven Mixing Machines and Sand or Mortar Mills, Platform Scales, Avery's 25-ton Railway Wagon Weighing Machine, Electric Winch and Boilards.

Contents of the ENGINEERING SHOP, Gap Lathes, Drilling Machines, Plano-Millers, Shafting, Hangers, Belting, 10 Electric Motors, A.C., Control Gear and Switches, etc., 10 Electric Clocks, a Humber 11.9-h.p. Motor-car.

OFFICE FURNITURE, Two Safes, Steel Filing Cabinets, Cupboards, Solid Oak Board-room Table, etc., etc.

Catalogues, when ready, will be sent on request to CHAS. A. CHARLTON, F.A.I., Auctioneer and Valuer, 26, Dennett Street, Nottingham ('Phone 41405), or from the Receivers, H. F. HOLLOWAY, Esq., F.C.A., c/o Messrs. Derbyshire & Company, Chartered Accountants, Wheeler Gate, Nottingham, or F. A. PRIOR, Esq., F.S.A.A., c/o Messrs. Prior & Palmer, Incorporated Accountants, Bridlesmith Gate, Nottingham.

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406 OSBORN jolt rollover.
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